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ABSTRACT

The Vocational and Industrial Training Board (VITB) of Singapore commissioned a review of its curriculum development process in order to identify ways that the process can be made more effective and efficient for trainees. The methodology included briefings, site visits, interviews, and review of curriculum documents. The following strengths of the process were found: high quality curriculum products; dedicated, skilled staff; use of new curriculum processes; state-of-the-art training facilities; industry involvement; and excellent public reputation of the VITB. Areas of concern were also raised: greater focus on content than competencies; lack of flexibility; need for quicker response to technological change; fragmentation of the curriculum development process; need for different types of instructional materials; and lack of encouragement for innovation and experimentation. Short-term, mid-term, and long-term recommendations were made that would accomplish the following: adjust programs to meet the needs of trainees; shorten new program development and course review time; increase knowledge of current skills required by jobs; respond to technological change; reduce process frustration; incorporate new and revised curriculum; and personalize and individualize trainee needs. (Twelve appendices present the following: model for training design and evaluation; organizational structure and major functions of the curriculum development division; VITB curriculum documents; approval of curriculum; consultancy program; list of persons contacted; elements of competency-based education; proposed curriculum model; Systematic Curriculum and Instructional Development systems approach summary; task analysis; task analysis form; and competency-based education and training background paper.) (NLA)

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CONSULTANCY REPORT ON CURRICULUM MODEL

Introduction

1 The Vocational and Industrial Training Board (VITB) was established in April 1979 as the national authority for the development and provision of vocational training in Singapore.

2 The major functions of the VITB Board and its professional staff are as follows:

2.1 Provision of full-time pre-vocational and skills training in industrial, commerce, and service skills for school-leavers to prepare them for work;

2.2 Provision of part-time courses for upgrading the skills and educational levels of the workforce through its industry-based and continuing education and training (CET) programmes;

2.3 Setting of skill standards, conducting public trade tests and examinations, and certifying attainment; and

2.4 Registration and administration of apprenticeship training and the junior trainee scheme.

3 VITB currently offers 48 courses at several different levels covering the commercial, industrial, and service areas. The highest level is the full-time 3-year diploma course for those who have completed secondary

education (10 years of school). The lowest level is the Basic Vocational Training courses for post-primary school leavers (persons who have completed 6-8 years of school). In addition, the VITB is charged with providing many part-time courses for upgrading the skills and educational levels of the Singapore workforce through its industry-based and continuing education programme. Its staff also coordinates, monitors, and provides technical advice to 36 Approved Training Centres (ATCs) operated by private industry.

4 As might be expected, developing and maintaining suitable and up-to-date curriculum and instructional materials for such wide ranging programmes and courses is a major challenge. Currently, most of the curricula are developed by in-house curriculum development specialists (CDSs) and curriculum development officers (CDOs) who consult with Training Development Committees (TDCs) and industry representatives through an extensive system of Training Advisory Committees (TACs).

Curriculum Development

5 The existing approach to curriculum development is based on the Model for Training Design and Evaluation presented in Annex A. This model was conceptualized in 1981 as part of a project on Work Oriented Education for In-School and Out-of-School Youth within the ASEAN Development Education Project carried out by VITB.

6 Since 1981, the model has been refined by CDSs of VITB to its present day form. Curriculum and instructional development in VITB is undertaken by the Curriculum Development (CD) Division. The principal functions of the CD Division are as follows:

6.1 Design institution-based and industry-based training courses;

6.2 Establish skill standards for occupations and design tests to measure attainment of the standards;

6.3 Develop instructional materials for training courses;

6.4 Plan training facilities and equipment for training courses; and

6.5 Monitor, evaluate, and review training courses.

7 The current organizational structure and major functions of the CD Division are portrayed in Annex B. The Division consists of 4 departments, each with its own manager as follows:

7.1 Curriculum Design Department;

7.2 Training Standard Department;

7.3 Instructional Development Department; and

7.4 Academic and Related Studies Department.

The CD Division has an approved staffing of 22 CDSs and currently employs 18 specialists. CDOs are assigned for varying periods of time to work with the CDSs as needed. The CDOs are usually training officers or heads of

department.

8 Using a project team approach, the professional staff of the CD Division has been responsible for developing the following VITB curriculum documents (see Annex C for a description of each document):

8.1 Training Standards Manual;

8.2 Training Specifications Manual;

8.3 Progress Test Manual;

8.4 Practical Work Manual;

8.5 Standard Training Equipment List (STEL); and

8.6 Institutional Norms (INs).

9 Approval of the curriculum products follows a 5-step process that starts with the CD Manager, a TDC, a TAC, and the Directorate. In the case of the skills standards, the document also goes to a Vocational Certification Committee for its approval. See Annex D for a depiction of the approval process.

10 Each CD Department currently has 3 or more CDSs. CDOs are temporarily assigned to each department on either a full-time or part-time basis according to need. See Annex B for a chart outlining the organizational structure and major functions of each department.

Terms of Reference

11 In April 1989, the VITB Board invited proposals from external consultants to conduct an independent evaluation of the existing curriculum model and its associated curriculum and instructional development processes. The consultant was charged with providing an indepth review of the processes being used and the products developed in order to identify areas where improvements could be made. Six weeks of time were allocated for this endeavour which began on 16 February 1990. The specific terms of reference are as follows:

11.1 To review the existing VITB curriculum model;

11.2 To identify the areas of weakness in the curriculum development processes;

11.3 To propose actions for refinement and improvement of the model;

11.4 To conduct clinics/workshops for CDSs in identified areas of concern; and

11.5 To prepare and present to staff and the Directorate a final report of findings and recommendations.

Methodology

12 The methods used for the study were as follows:

12.1 Briefings by VITB personnel including -

12.1.1 Curriculum Division Director;

12.1.2 Curriculum Division Managers;

12.1.3 Curriculum Division Specialists;

12.1.4 Curriculum Development Officers;

12.1.5 Two Training Managers;

12.1.6 One Approved Training Centre Manager;

12.1.7 Numerous Training Officers;

12.1.8 Numerous Training Instructors;

12.1.9 Several Heads of Department;

12.1.10 Manager of Industry-Based Training Department;

12.1.11 Programme Officers of IBT;

12.1.12 Manager and Staff of Tests and Exams;

12.1.13 Supervisors of Training Institutes; and

12.1.14 Manager of the Counselling & Vocational Guidance Department.

12.2 Visits to 2 Vocational Institutes as follows:

12.2.1 Ang Mo Kio; and

12.2.2 Bukit Merah.

12.3 Visit to the Borneo Motors Approved Training Centre;

12.4 Attendance at a Commercial Training Advisory Committee meeting;

12.5 Interviews with the following personnel –

12.5.1 Deputy Director/Professional Development;

12.5.2 Divisional Director/Curriculum Development;

12.5.3 Divisional Director/Instructional Media;

12.5.4 Librarian/Centre of Vocational Training; and

12.5.5 Selected Chairmen of Training

Development Committees;

12.6 Extensive review of many curriculum documents and related materials including:

12.6.1 Various Training Standards;

12.6.2 Various Training Specifications;

12.6.3 Various Practical Work Manuals;

12.6.4 Various Progress Tests;

12.6.5 Trade Textbooks;

12.6.6 Academic Textbooks;

12.6.7 Teachers' Guides;

12.6.8 Reference Texts;

12.6.9 Training Development Committee minutes;

12.6.10 Training Advisory Committee minutes;

12.6.11 DACUM charts;

12.6.12 Curriculum Development in VITB paper;

12.6.13 Identification of Training Needs paper

12.6.14 A Guide on Apprenticeship Training;

12.6.15 A Guide to Curriculum Development;

12.6.16 Miscellaneous prospectuses, flyers, brochures, etc; and

12.6.17 Divisional target reports.

13 The interviews and briefings covered all aspects of instruction and curriculum development. VITB personnel were in all cases very helpful, sincere, and frank in their responses to the consultant's inquiries.

14 The first 2½ weeks were devoted to visits, briefings, interviews, and curriculum document reviews while the consultant was in Singapore. The next 2 weeks of time were devoted to a further review of selected documents and to the preparation of this report while based at the Center on Education and Training for Employment, The Ohio State University, Columbus, Ohio.

15 While at Columbus, the consultant also collected reference materials, conferred with several colleagues, contacted other specialists for specific documents, and prepared papers and transparencies for use in conducting clinics and workshops for VITB staff the last 1½ weeks of which was spent at VITB, Singapore.

16 The presentation of a draft report was made to the Directorate and Managers of CD Division the first week and after some modifications, the final report was presented to members of the Directorate, Training Managers, Heads of Department and the CD Division. During the last 1½ weeks, the consultant conducted 10 workshops for selected VITB staff on the following topics:

16.1 The Alternative SCID Curriculum Model;

16.2 DACUM Process and Quality Control Update;

16.3 Task Analysis Procedures;

16.4 Process for Curriculum Revision;

16.5 Conducting Literature Searches;

16.6 Developing Business Industry Training Programmes;

16.7 Competency-Based Education and Training;

16.8 Development of CBE Learning Guides;

16.9 Evaluating Course Effectiveness; and

16.10 Occupational Competency Performance Testing.

17 A copy of the programme for the consultant's visit is attached as Annex E and a roster of the 63 persons with whom he conferred is contained in Annex F.

Consultancy Goals

18 The overall purpose of the consultant's study of the VITB curriculum development process was to identify and recommend ways that the process can be made more effective and more efficient for the many trainees that VITB serves. The enormity of the curriculum development task faced by VITB becomes apparent when one realizes that over 17,000 trainees are being served in full-time institutional programmes and overall 100,000 workers are being served yearly in one or more Continuing Education and Training (CET) programmes for workers.

19 After careful study of the many documents made available and a review of the extensive notes taken during briefings and interviews, the consultant recommends realistic ways of accomplishing the following 8 specific goals:

19.1 To increase the amount of flexibility in the curriculum such that training officers and instructors have more freedom to adjust their programme to meet the needs of their trainees;

19.2 To shorten the amount of time required for both new programme development and the review and revision of existing courses;

19.3 To increase the involvement of expert workers from business and industry in the curriculum process because they possess the most current knowledge and skills required by the job;

19.4 To improve the response of the curriculum process to the technological changes that are occurring in industry;

19.5 To recommend ways to reduce at least some of the frustration (voiced by some CDSs, CDOs, TMs, HODs, and TOs) that is associated with the current process;

19.6 To recommend ways to incorporate new and refined curriculum and instructional development techniques into VITB's process;

19.7 To recommend steps that VITB can take to move its training programmes in the direction of making learning the constant and time the variable; and

19.8 To recommend ways that VITB can make its instruction more individualized and personalized to the needs of its trainees.

20 A systematic approach to curriculum and instructional development is extremely important not only because the materials produced play such a significant part in the learning equation, but also because the process of curriculum development and revision can be complex and cumbersome without an efficient system. Without an effective and efficient system, instructors and trainees may have to utilize less than optimum materials. With such a system, it is easier to analyze exactly where and what the training needs are, what types of materials will best meet the needs, and what has to be done to produce those materials.

21 The cost of not periodically reviewing and revising the curriculum process has serious implications for the instructional staff, VITB's trainees, and the Singaporean society. The consultant would like to commend the VITB Board and management for seeking a comprehensive review of its curriculum development process.

Current Successes/Strengths

22 It is appropriate to identify the major successes and strengths of the current curriculum development process before reviewing the areas of concern. The consultant is pleased to enumerate the following 10 areas of success:

22.1 The CD Division staff are currently meeting or exceeding its development and review targets in all product development areas;

22.2 The VITB can be very proud of the dedication, skill, and professionalism of its CD division staff;

22.3 The quality of the various curriculum products being produced is very high in almost every case. The staff and managers deserve high praise for their consistent pursuit of quality;

22.4 Commendable efforts are being made to utilize and incorporate new curriculum processes such as DACUM job analysis and computer-based instructional techniques into the development effort;

22.5 The instructional media support facilities and services are excellent and state-of-the-art;

22.6 The VITB curriculum process provides for considerable industry involvement via use of the DACUM process, the 13 training advisory committees, and quarterly visits to industry by the Board and Directorate;

22.7 Excellent quality education and training programmes are being delivered. This could not happen without a strong curriculum development effort;

22.8 The curriculum development effort appears to be meeting the needs of many school leavers (over 17,000 in 1988-89) and many workers (over 100,000 in 1989) to a very high degree;

22.9 The public reputation of VITB is excellent as evidenced by positive editorials and by the many job advertisements that speak of wanting employees who have achieved NTC-2 or NTC-3 levels; and

22.10 The existing curriculum model has served VITB well - it has been used several years as a framework for developing many training materials of high quality.

Areas of Concern/Weakness

23 As might be expected, several areas of concern or weakness were raised by the over 60 persons who were interviewed and through the review of the various documents and information obtained through the briefings. The consultant made a serious effort to triangulate or confirm from more than one source issues of concern that were raised. The major concerns identified are as follows:

23.1 Some courses examined by the consultant appear to focus on identifying and presenting the content believed important rather than focusing on the competencies needed by successful workers. While a definite concern, note should be made that the recent introduction of the DACUM process appears to signal a move from the content-based focus to a competency-based one. The recently produced Skills Standard (1990) for

Physical Conditioning reflects the competency-based approach, for example, while a document for the Electronics Principles & Practices II (1988) emphasizes a content focus;

23.2 The current training programme design is a time-based one that lacks much flexibility for either the training staff or the trainees. This approach results in making learning the variable and time the constant rather than vice versa. Several training officers expressed a sincere and deep concern about inadequate flexibility and decision-making on their part;

23.3 There is a need for a quicker response to technological change in the occupations being addressed. While development and revision times vary, depending on the availability of needed personnel and other factors, the time frame for both procedures should be shortened;

23.4 The current development process is unnecessarily fragmented because of the division's organizational structure. Currently in the development of a new programme 2 or 3 different project teams would be constituted. Nearly all of the CDSs expressed concern about this organizational arrangement because it does not allow for continuity in the development process and often means the CDSs are working in an occupation for which they have little or no

knowledge and lack personal confidence;

23.5 The process at the present lacks a comprehensive approach to task analysis which if well organized and conducted, could save much time, reduce much of the current CDSs' frustration, and produce valuable instructional development information;

23.6 Curriculum Development Officers are sometimes being asked to perform tasks for which they are not well qualified. Several training officers spoke of their reluctance to accept CDO assignments to revise and update curriculum. They feel first, a loyalty to their trainees and secondly, that they cannot write quality curriculum about the new technologies when, in most cases, they personally have had limited or no experience with them;

23.7 There is a need to obtain more frequent and more substantive input from industry experts both when developing and when revising courses. Industry expert workers are the most knowledgeable of the new skills needed and the technological changes occurring - their substantive input to the job analysis and task analysis process is critical;

23.8 There is a need to produce a different type of instructional resource for use by both the trainees and instructors. Inflexible textbooks and manuals for most vocational subjects should be replaced by some type of learning packages which are competency-based and more suitable for individual and small group use;

23.9 There are too many levels of approval required for curriculum documents. A serious effort should be made to determine how some of the approvals might be eliminated and/or speeded up;

23.10 More attention should be given to efforts to integrate the academic and vocational instruction so as to achieve a higher level of basic skill development among the trainees;

23.11 The CD Division needs a better staffing structure for providing quick response consultative and technical assistance in curriculum development and other training matters to industry if that role is to be accepted by VITB;

23.12 The CD Division staff do not currently conduct computerized searches of the literature before they begin a new development effort. Much time and money can be saved by acquiring and selecting/adapting existing print and audiovisual materials whenever possible;

23.13 The CD Division staff need more opportunities

and time for continuing their own professional development and upgrading their curriculum and instructional development skills;

23.14 The CDSs need more and closer secretarial and technical support. Considerable professional time of the CDSs is now consumed in doing some of their own copying, carrying materials back and forth from the clerical pool, and in collating and mailing materials;

23.15 The CD Division should be equipped with more of the latest technology (word processing, microcomputers, authoring software) for both managing the complex curriculum process and to aid in the actual development of high quality materials;

23.16 The duties, tasks, and responsibilities of the various departments within the CD Division should be more clearly defined. As much authority as possible should be given to the CDSs and their curriculum project teams;

23.17 The VITB should encourage and permit a reasonable degree of curriculum innovation and experimentation at the training officer, training instructor, and head of department level. The process currently being used is perceived by some as highly centralized and very prescriptive; and

23.18 Although difficult to accomplish, the TACs need to be more effectively utilized. They need to be encouraged to initiate issues rather than responding to VITB requests and primarily reviewing curriculum documents.

Summary of Findings

24 These findings have emphasized the weaknesses uncovered because it is through the correction of these that major improvements may be made. It would be misleading, however, to let the concerns identified overshadow the many strengths that are also present. High among the many positives are the professional dedication and competence of the CD Division managers and staff, and the high quality of the many curriculum documents that have been systematically produced. Also noteworthy is the fact that both the staff and managers appear to be very open to constructive changes that ultimately benefit the VITB trainee. Such an attitude will make the recommended changes which follow much easier to accomplish.

Recommendations

25 The following recommendations are focused on reducing or removing the identified concerns and weaknesses (para 23) that exist in the present curriculum process. The goal sought is to help make more achievable the VITB mission statement which reads "Every worker should have

the means to attain the highest level of competency in his vocation or skill." The recommendations which follow are made with that overall mission in mind and with the full realization that the curriculum utilized in any training or educational endeavour is one of the essential ingredients to success. It is felt the changes recommended will make the curriculum process more effective and efficient as well as more responsive to the rapidly changing technological world in which we live.

26 The recommendations are grouped into 3 categories in order to provide an overall plan which is realistic and achievable. Recommendations are categorized as short-term (ie those which can be implemented within 12 months), mid-term (ie can be implemented within 2-3 years), and long-term (those requiring more than 3 years).

Recommendations, Short Term

27 The following short-term recommendations are offered:

27.1 Adopt the competency-based education/training (CBE) approach to instruction as described in Annex L entitled "A Humanistic and Realistic Approach to Technical and Vocational Instruction." See the Elements of CBE in Annex G for a list of the essential elements and desirable characteristics of CBE programmes;

27.2 Adopt the Systematic Curriculum and Instructional Development (SCID) Model (as

portrayed in Annex H) as a replacement for the current curriculum model. See Annex I for more information about the major activities, outcomes, and products that are involved in utilizing this rigorous and systematic approach.

27.3 Identify a select team of appropriate representatives of the Directorate, CD Division and training staff (TM, HOD, TOs) to take an on-site tour and inspection of model CBE programmes operating in the United States and Canada. Upon their return to VITB, this team should be charged with providing a steering and planning committee type of leadership in developing a comprehensive plan for the implementation of CBE throughout the VITB System (if they judge such action is merited). This cadre should continue to perform in a leadership role as the implementation process is carried out;

27.4 Develop a comprehensive plan to provide appropriate and indepth professional training in both CBE and SCID for all VITB personnel on a sequential basis;

27.5 Conduct a rigorous DACUM job analysis as the beginning point for all new training programmes being developed, and a one-day modified DACUM Update job analysis for all training programmes being revised;

27.6 Adopt a DACUM PLUS concept for courses or

programmes where there may be justifiable reasons for including content (historical, institutional requirements, legal requirements, etc) that goes beyond the requirements of the trade or job. The key point here is that when additional content/skills/attitudes are to be addressed, that information should be clearly identified along with the reasons for its inclusion;

27.7 Immediately begin to conduct a comprehensive DACUM type task analysis to rigorously analyze the tasks that are identified in the job analysis workshops. See Annex J for an outline and Annex K for a sample task analysis outlining the type of information to be collected. Expert workers from business and industry should be utilised when conducting a DACUM task analysis to obtain all of the up-to-date information needed to prepare the "training programme performance standards" report (analysis phase product). If the workers must be paid, it should be done because this information must be obtained and can result in major savings later on;

27.8 Reorganize the curriculum project teams for all new curriculum development and revision efforts such that whenever possible the CDS leading a curriculum project is assigned according to his/her own occupational specialty to the

maximum extent possible. Also charge each team with the full development process and hold it accountable for high quality and reasonable productivity. Several efficiencies will be gained by this type of structure as one unit will not have to wait for another, time will not have to be spent organizing a new project team, studying the previous team's work, etc;

27.9 Make conducting a thorough computerized search of ERIC and other relevant data bases a required early step in both the development of new training programmes and in the revision and updating of existing courses. There are enormous amounts of high quality curriculum and instructional material available for most occupations. A search for relevant print and supportive audiovisual material could save lots of development time and cost. It is much easier and quicker to select and adapt materials where possible, and to develop only the locally specialized materials unavailable from other sources. Serious consideration should be given to acquiring CD-ROM equipment and a subscription to one of the CD-ROM ERIC disc production service;

27.10 Develop a standard VITB format for all DACUM competency profiles. While the DACUM chart should become a standard part of training programme performance standards, it should also

be used in other ways. Therefore, a high quality artistic design should be prepared and used as a basic design and format for all charts. Decisions should also be made about what additional data such as the date conducted, names of panel members, the name of the DACUM facilitator, worker behaviours, and general knowledge and skills, tools, equipment, supplies, materials, etc, will be consistently included. These profiles should be made readily available to parents, employers, and trainees;

27.11 Develop a standard VITB format for use in the development of CBE learning guides (this recommendation is made on the assumption that CBE will be adopted on at least a trial basis). Along with the agreed-upon format, it is strongly recommended that a "developer's guide" be prepared to serve as a key reference for all CDSs and CDOs;

27.12 Reduce the number of approvals currently required to save time and money, and to give more authority and responsibility to the curriculum specialists and training committees. Specifically, it is recommended that the Directorate approval be discontinued because the personnel at that level usually do not possess the technical expertise necessary to make curricular content decisions. It is also

suggested that the curriculum be submitted to both the TDC and TAC concurrently so as to shorten the development and revision cycle. Basically, the CDSs and the CDOs should be trusted to make appropriate use of the job and task analysis data. The quality control function should be delegated to the CD Division managers and the 2 committees;

27.13 Involve the instructional staff (TOs, TIs, HODs) in more appropriate ways so that they will acquire more of a professional responsibility for the curriculum being developed. Some TOs confided to the consultant that they oppose assignments to the CDO role whenever they can because of the frustration that often goes with it. It is recommended that the instructional staff be involved in such development activities as:

27.13.1 Helping identify expert workers for the DACUM job and task analysis activities;

27.13.2 Helping identify expert workers and/or first line supervisors who can respond to the task verifications;

27.13.3 Inviting them to observe the DACUM workshop;

27.13.4 Inviting them to curriculum development and implementation workshops so they will better understand and support the

process; and

27.13.5 Assisting with the development of materials using data from task analysis and material acquired through computer searches.

27.14 That serious consideration be given to using the DACUM competency profile as one form of achievement record (transcript) which the trainees could use when seeking employment or transferring into another training/educational programme;

27.15 Provide specific opportunities for all CDSs to continue their professional growth and development. Overseas study opportunities should be made available for the pursuit of advanced curriculum development study and the pursuit of undergraduate and/or graduate degrees. Also provision might be made for short-term attachments at model CBE institutions, at the Ohio State University's Center on Education and Training for Employment, and other selected institutions;

27.16 The VITB should continue to make use of appropriate CBE programme implementation specialists as the implementation process gets underway. The consultant can make numerous recommendations if desired;

27.17 A procedure should be devised whereby the expert workers can be obtained for a full 2 days if needed to conduct a high quality job analysis. In some cases, the VITB may need to pay the expert workers and conduct sessions in the evenings or on weekends so as to gain the required expertise;

27.18 As currently being conducted, the DACUM process is not being used to identify the very important worker behaviours (traits and attitudes) that are so important to an employee's success. The important behaviours should be identified for the whole job during the job analysis and for each task during the task analysis process; and

27.19 Give permission for TOs to incorporate new technological concepts into their training programmes before the change is officially adopted by the curriculum revision process. Only the approval of the HOD should be required, along with eventual written notification to the CD Division.

Recommendations, Mid-Term

28 The following mid-term recommendations are made:

28.1 The CD Division should acquire the resources and a mechanism to provide quick response needs assessment, job and task analysis, and other training and curriculum development services to

business, industry, and governmental agencies. The rationale for providing these services is threefold. First, VITB has personnel, who with minimal additional training could be well qualified to provide these services. Second, providing them in a quick response and quality manner would help strengthen the economic viability of the companies. Perhaps most important, from the view point of VITB's main responsibility, is that providing such services on a cost-recovery basis will further strengthen the VITB's linkages with industry;

28.2 Conduct a DACUM job and task analysis of the VITB CDS's job to clearly define it for all concerned. Since the CDS's job could change considerably if the recommendations presented in this report are implemented, this activity should be carried out about 2 years from now;

28.3 Conduct a pilot test of the CBE programme design in about 3 trade areas, once appropriate materials have been developed or acquired and instructional staff and training managers have prepared for their new roles and responsibilities. A good formative evaluation process should be used to guide in-course corrections as may be necessary;

28.4 Continue the implementation of professional training on CBE and SCID as appropriate ie,

management training for leadership personnel such as supervisors, TMs, and HODs and pedagogical training for TOs and TIs;

28.5 A 2 to 5 year effort should be launched with the goal of identifying core skills, sometimes called transferable skills, that are utilized in several jobs or occupations. The trainee who acquires a good number of core skills will likely have more employment opportunities available and will even be better positioned to transfer from one job to another within the same company;

28.6 A similar effort is recommended to explore ways to integrate academic and vocational instruction. A number of pilot efforts recently carried out in the United States have proven very successful in helping to improve the students' motivation and acquisition of basic skills;

28.7 It is recommended that increased attention be given to the use of new instructional technologies like computer-based instruction. Some very successful basic math and English language skill programmes have been developed (eg IBM PAL system) to help in remediating the basic skills of learners;

28.8 Opportunities for TOs and TIs to obtain technical skill and subject matter updates were reported by some to be quite limited. This should be taken

seriously and action needs to be taken to expand the opportunities for short-term industrial placement, attendance at company technical update meetings, trade shows, etc. It is further recommended that at least one Saturday each term be devoted to technical update and/or professional development. Such an activity could be planned by a committee of HODs, TOs, and TIs and might involve visits to industry, industry experts conducting seminars, etc; and

28.9 Consider joining the National Alliance of Community and Technical Colleges, a consortium of institutions through the United States that represent leadership institutions most of which are heavily involved in CBE programme operations. They are officially seeking international members and would welcome VITB's application. Members have wide access to each other's curriculum materials and annually conduct professional development conferences, seminars, etc.

Recommendations, Long-Term

29 The following long-term recommendations are advanced:

29.1 Continue the implementation of CBE into all VITB training programmes;

29.2 Continue to refine the CBE programmes that were initially developed; and

29.3 Conduct some summative evaluations of the CBE training programmes to determine their cost, overall effectiveness, and areas where further improvements can be made.

Conclusion

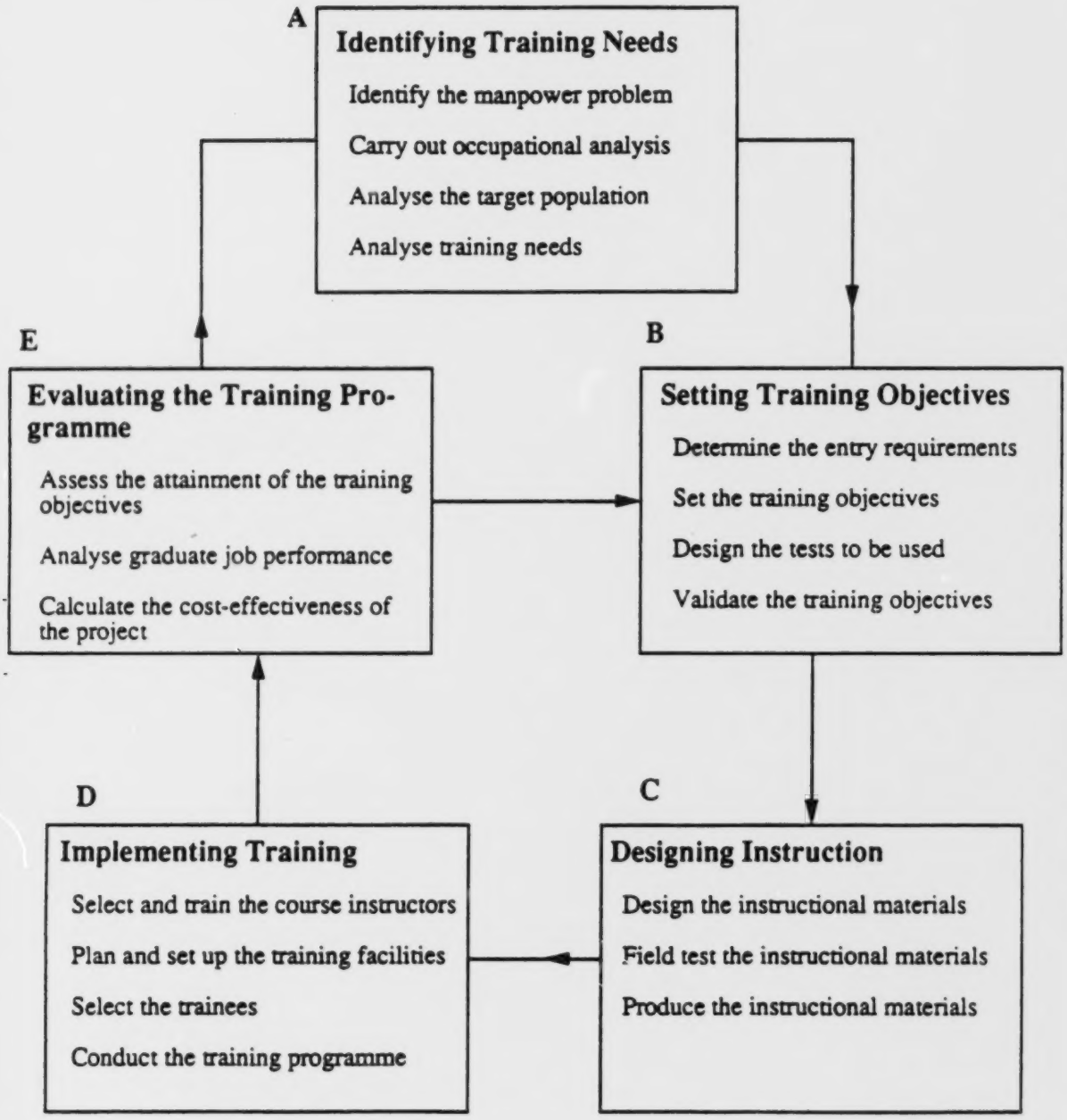
30 This comprehensive review of the VITB curriculum development process is only one step in the very important process of meeting the needs of VITB trainees in the best manner possible. The goal, as stated earlier, has been to look for ways to improve the effectiveness and efficiency of the curriculum process. This review has revealed that there are significant areas of concern/weakness in the present system of curriculum development. Some of these concerns can be remedied fairly quickly while others will require more time and effort, if fully implemented. The consultant, based on his considerable experience with CBE, DACUM, and curriculum development, believes all of the recommendations can be accomplished and would result in considerable enhancement of VITB's many training programmes.

31 The current staff while very capable, hard working, and dedicated should be afforded adequate consultant assistance and additional training opportunities for themselves, in order to assure the successful implementation of both CBE and SCID. The provision of high quality curriculum development under the SCID model

and the effective implementation of CBE programmes requires properly trained staff who understand fully the new concepts involved and who possess the necessary skills and attitudes to make both activities successful.

32 Last, but certainly not least, it remains for the consultant to express sincere thanks to all of the VITB staff he has had contact with for their help, cooperation, and assistance which has been so freely given during his stay. He would especially like to thank persons who patiently responded to the many questions asked, and persons who sought and shared the many publications and reports requested. He has never worked with a finer group of professionals, a group who in this case are dedicated to doing their part to serve the VITB trainees and doing it very well.

Model for Training Design and Evaluation



ORGANIZATIONAL STRUCTURE AND MAJOR FUNCTIONS OF THE CURRICULUM DEVELOPMENT DIVISION

Curriculum Design

- Needs Identification
- Curriculum Design
- DACUM Workshops
- Consultancies
- Trade Textbook Development
- Computer-Based Instruction

Training Standard

- Skills Standard
- DACUM Workshops
- Test Criteria
- TACs Operations
- ATC Approvals

Instructional Development

- Training Specifications
- Instructional Materials
- TDCs Operations

Academic and Related Studies

- English Language
- Math
- Science
- Related Subjects
- TDCs Operations

VITB CURRICULUM DOCUMENTS

1 Training Standards Manual

The Training Standard for a course comprises the skills standard/test syllabus and test plans. These 2 documents are used to guide setters and moderators of test papers so that a consistent standard is maintained for every series of test conducted.

2 Training Specifications Manual

This manual serves as a teaching guide for the instructor. It lays down the content of each unit of instruction and specifies what the trainees is able to do after instruction. The instructions are written behavioural terms. A curriculum feedback form is provided at the end of the manual to enable training staff to give their comments or suggestions at any point during the implemention stage.

3 Progress Test Manual

This manual contains a series of progress tests. A short progress test is administered at the end of each theory lesson to provide feedback to the instructor on the trainees' progress and to help consolidate instruction. These tests are not used to assess trainees' performance. A curriculum feedback form is also included.

4 Practical Work Manual

This manual contains a number of practical assignments which the trainee is required to perform to develop and consolidate his skills. It also contains one or more practical test projects to measure the attainment of skills after the trainee has completed a cluster of skills in his assignments. A curriculum feedback form is also provided.

5 Standard Training Equipment List (STEL)

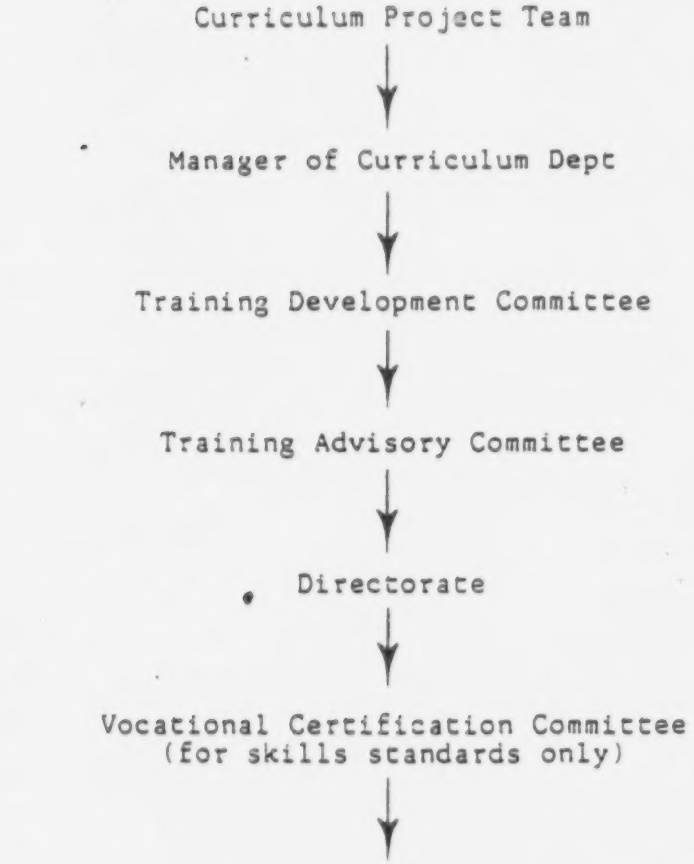
A STEL specifies the type and minimum quantity of equipment and tools needed to conduct a specific training course effectively. It also gives an estimated cost of each of the items listed.

6 Institutional Norms (INs)

INs are standard guidelines established to facilitate provision of the physical space for classrooms, laboratories, workshops and other common facilities in VITB's training institutes.

Annex D

APPROVAL OF CURRICULUM



VOCATIONAL & INDUSTRIAL TRAINING BOARD, SINGAPORE

CONSULTANCY ON EVALUATION OF VITB CURRICULUM MODEL

Programme for Dr Robert Norton

For the Periods 19 Feb - 7 Mar 90 and 16 - 25 Apr 90

First Phase

1st week
19 Feb - 24 Feb 90

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Mon 19 Feb	0930 - 1230 hrs	Orientation	CVT Rm 2	M/CR	Consultant, M/CR
		Briefing on administrative matters - employment pass, passport			
	1430 - 1530 hrs	Clarification of terms of reference of consultancy	CVT Rm 2	DD/CD	Consultant, DyD/P, DD/CD, M/CR
	1530 - 1700 hrs	Briefing on roles and functions of VITB	CVT Rm 2	DD/CD	Consultant, DD/CD M/CR
		Briefing on VITB Certification System			
		Briefing on Curriculum Design and Development in VITB			

* CDS/CRI will be in attendance in all meetings and discussions to help the consultant

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Tue 20 Feb	0900 - 1030 hrs	Discussion on and review of process of identifying training needs	CVT Rm 2	M/CR	Consultant, M/CR, CDSs of CR Dept
	1045 - 1215 hrs	Discussion on and review of process of setting training standards	CVT Rm 2	M/TS	Consultant, M/TS, CDSs of TS Dept
	1230 hrs	Lunch hosted by the Director of VITB	Harbour City	M/ER	Consultant, DVIT, DyD/P, DD/CD, M/CR
	1430 - 1700 hrs	Mapping out study strategy	Office	Consultant	-
Wed 21 Feb	0900 - 1100 hrs	Discussion on and review of process of instructional design	CVT Rm 2	M/ID	Consultant, M/ID, CDSs and CDOs of ID Dept
	1115 - 1300 hrs	Discussion on and review of process of instructional design for academic and related studies	CVT Rm 2	M/AR	Consultant, M/AR, CDSs and CDOs of AR Dept
	1430 - 1700 hrs	Discussion on curriculum implementation in industry-based training	IBT Meeting Room	M/IBT	Consultant, M/IBT, POs of IBT Dept
Thu 22 Feb	0900 - 1100 hrs	Discussion on test management	CVT Rm 2	M/TEA	Consultant, M/TEA, TEds, TEAOs and TEDOs
	1100 - 1300 hrs	Open	Office	Consultant	-
	1400 - 1700 hrs	Discussion on role of TACs in curriculum development	NIC Conference Rm	DD/CD	Consultant, CMTAC, M/TS, CDS/TSI

37

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Fri 23 Feb	0900 - 1300 hrs	Discussion on curriculum implementation	Board Room B (Voc Dr)	S/TI3	Consultant, S/TI2, S/TI3, M/CVG
	1400 - 1700 hrs	Examination of information on activities carried out in various phases of curriculum development : Identifying Training Needs Setting Training Standard Designing Instruction Implementing Training Evaluating Training Programme	Office	Consultant	-
Sat 24 Feb	0900 - 1300 hrs	Examination of information on activities carried out in the various phases of curriculum development (cont'd)	Office	Consultant	-

2nd week

26 Feb - 3 Mar 90

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Mon 26 Feb	0900 - 1030 hrs	Visit to a training institute to view training facilities and resources for various courses	AMKVI	TM/AMKVI	Consultant, TM/AMKVI, HODs/AMKVI
	1030 - 1230 hrs	Discussion with Training Manager and staff on curriculum implementation and evaluation	AMKVI Conference Rm	TM/AMKVI	Consultant, TM/AMKVI HODs/AMKVI, Staff of AMKVI
	1400 - 1700 hrs	Open	Office	Consultant	-

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Tue 27 Feb	0930 - 1230 hrs	Examination of training and curriculum implementation in an approved training centre	Borneo Motors Pte Ltd	Michael Koh (Service/ Training Manager)	Consultant, PO/IBTI,
	1400 - 1700 hrs	Open	Office	Consultant	-
Wed 28 Feb	0900 - 1030 hrs	Visit to a training institute to view training facilities and resources for electrical and electronics courses	BMVI	TM/BMVI	Consultant, TM/BMVI, HODs/BMVI
	1030 - 1300 hrs	Discussion with Training Manager and staff on curriculum implementation and evaluation	BMVI Conference Rm	TM/BMVI	Consultant, TM/BMVI, HODs and staff of BMVI
	1400 - 1700 hrs	Open	Office	Consultant	-
Thu 1 Mar	0900 - 1100 hrs	Discussion on the role of TDCs in curriculum development	Board Rm A	DD/CD	Consultant, DD/CD, M/AR, M/ID, TDC Chairmen
	1100 - 1300 hrs	Open	Office	Consultant	-
	1400 - 1700 hrs	Review of curriculum materials	Office	Consultant	-
Fri 2 Mar	0900 - 1700 hrs	Review of curriculum materials	Office	Consultant	-
Sat 3 Mar	0900 - 1100 hrs	Briefing on the role of IM Divn in curriculum development	Office	DD/IM	Consultant, DD/IM
	1100 - 1300 hrs	Examination of AVA materials	Office	Consultant	-

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
3rd week					
5 Mar - 7 Mar 90					
Mon 5 Mar	0900 - 1300 hrs	Drafting of interim progress report	Office	Consultant	-
	1430 - 1600 hrs	Discussion on curriculum development	CVT Rm 2	Consultant	Consultant, DyD/P
Tue 6 Mar	0900 - 1300 hrs	Open	Office	Consultant	-
	1430 - 1700 hrs	Presentation of interim progress report (Oral)	CVT Rm 2	DD/CD	Consultant, DyD/P, DD/CD, Managers of CD Divn
Wed 7 Mar	0900 - 1300 hrs	Discussion on workshops for CDSs	CVT Rm 2	Consultant	Consultant, DD/CD, Managers of CD Divn
	1430 - 1700 hrs	Discussion on computer conferencing	CVT Rm 1	Consultant	Consultant, DD/CD, NPB staff

Final Phase

1st week

16 Apr - 21 Apr 90

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Mon 16 Apr	0900 - 1230 hrs	Review of draft report	Office	Consultant	-
	1300 hrs	Printing and circulation of draft report	-	CDS/CR1	-
Tue 17 Apr	0900 - 1230 hrs	Presentation of draft study report	Board Rm A PSA Building	Consultant	DVIT, DyD/P, DyD/T, DD/CD, DD/PD, DD/IM, DD/RT, M/CR, M/TS, M/ID, M/AR, M/IBT
	1400 - 1700 hrs	Drafting of final report	Office	Consultant	-
Wed 18 Apr	0900 - 1300 hrs	Drafting of final report	Office	Consultant	-
	1430 - 1700 hrs	Talk on Trends and Issues in Vocational & Industrial Training in the States	CVT Theatrette	Consultant	VITB staff

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Thu 19 Apr to Sat 21 Apr	0900 - 1700 hrs	Workshops for CDSs : Alternative Curriculum Model DACUM Update Task Analysis Process for Curriculum Revision Conducting Literature Search Developing Business-Industry Training Programmes (Needs Assessment) Competency-based Education (Training) Development of Learning Guides Course Effectiveness Evaluation Occupational Competency Testing	Lecture Rm 2	Consultant	CDSs
Sat 21 Apr	0900 hrs	Printing and circulation of draft final report	-	CDS/CRI	-

2nd week

23 Apr - 25 Apr 90

Date	Time	Activity	Venue	Person Responsible	*Person(s) Involved
Mon 23 Apr	0900 - 1230 hrs	Workshops for CDSs (cont'd)	Lecture Rm 2	Consultant	CDSs
	1430 - 1645 hrs	Discussion on test item development and banking	T&E Conference Rm	Consultant	M/TEA, M/TED
Tue 24 Apr	0900 - 1130 hrs	Evaluation of consultancy project Discussion on follow-up actions	CVT Rm 1	Consultant	Consultant, DyD/P, DD/CD, Managers of CD Divn
	1430 - 1600 hrs	Discussion on issues pertaining to vocational training	DVIT Office	DVIT	Consultant, DVIT
Wed 25 Apr	0900 - 1200 hrs	Presentation of consultancy report	CVT Theatrette	Consultant	DD/CD, DD/CET, DD/INT, TMs, HODs, Managers of CD Divn, CDSs, CDOs
	0900 - 1700 hrs	Workshops for CDS (cont'd)	Lecture Rm 2	Consultant	CDSs

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LIST OF PERSONS CONTACTED

VITB Directorate

1	Dr Law Song Seng	-	Director & Chief Executive Officer
2	Young Pak Nang	-	Deputy Director/Professional Development
3	Ng Ah Seng	-	Divisional Director/Curriculum Development
4	Wong Nyip Toong	-	Divisional Director/Instructional Media

Curriculum Design Department

5	Cheong Sun Sin	-	Manager/Curriculum Design
6	Miss Choo Nah Nah	-	Curriculum Development Specialist/ Curriculum Design
7	Stephen Chan Kim Seng	-	Curriculum Development Specialist/ Curriculum Design
8	Tan Peng San	-	Curriculum Development Specialist/ Curriculum Design

Training Standard Department

9	Mrs Seow-Tang Hong Ying	-	Manager/Training Standard
10	Mrs Chiew Choong Hing	-	Curriculum Development Specialist/ Training Standard
11	Koh Boon Leng	-	Curriculum Development Specialist/ Training Standard
12	Poh Kheng Guan	-	Curriculum Development Specialist/ Training Standard)
13	Chia Teck Chong	-	Curriculum Development Specialist/ Training Standard)

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DW4/CR5 - Persons.Doc 1+

Instructional Development Department

14	Lee Fook Kee	-	Manager/Instructional Development
15	Abdul Rahim Bin Mahmood	-	Curriculum Development Specialist/ Instructional Development
16	Miss Ho Mun Yee	-	Curriculum Development Specialist/ Instructional Development
17	Seow Kin Siong	-	Curriculum Development Specialist/ Instructional Development
18	Mrs Seah-Teo Beng Ngoh	-	Curriculum Development Specialist/ Instructional Development
19	Sim Chin Hang	-	Curriculum Development Specialist/ Instructional Development
20	Gerald Tay	-	Curriculum Development Specialist/ Instructional Development
21	Teo Guan Teng	-	Curriculum Development Specialist/ Instructional Development
22	Wah Tee Boon	-	Curriculum Development Officer/ Instructional Development
23	Cheng Joo Juan	-	Curriculum Development Officer/ Instructional Development

Academic & Related Studies Department

24	Chong Fook Keow	-	Manager/Academic & Related Studies
25	Miss Iris Seet	-	Curriculum Development Specialist/ Academic & Related Studies
26	Sunny Ng	-	Curriculum Development Specialist/ Academic & Related Studies
27	Wu Hoi Soon	-	Curriculum Development Specialist/ Academic & Related Studies
28	Miss Tan Juat Fong	-	Curriculum Development Officer/ Academic & Related Studies

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DW4/CR5 - Persons.Doc 2+

Tests & Exams Administration Department

29	Szeto Yee Jean	-	Manager/Tests & Exams Administration
30	Miss Jasmine Wong	-	Tests & Exams Administrative Officer

Tests & Exams Development Department

31	Lee Tong Seng	-	Tests & Exams Development Officer
32	Mohd Amanullah Bin Peer Mohd	-	Tests & Exams Development Officer

Institutional Training Department

33	Chiang Cheng Pun	-	Supervisor /Training Institutes
34	Soh Juin Wei	-	Supervisor /Training Institutes

Counselling & Vocational Guidance Department

35	Lim Chong Leong	-	Manager/Counselling & Vocational Guidance

Industry-Based Training Department

36	Ang Chai Soon	-	Manager/Industry-Based Training
37	Derrick Tan	-	Programme Officer/Industry-Based Training
38	Foo Chek Luan	-	Programme Officer/Industry-Based Training
39	Choo Gim Soon	-	Programme Officer/Industry-Based Training
40	Chang Kim Chai	-	Programme Officer/Industry-Based Training

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DW4/CR5 - Persons.Doc 3+

Staff of Ang Mo Kio Vocational Institute

41	Kok Kam Wah	-	Training Manager
42	Heng Boon Liat	-	Head of Department/ Basic Vocational Training I
43	Wong Sze Ho	-	Head of Department/ Basic Vocational Training II
44	Ong Kim Peng	-	Head of Department/ Metal Machining
45	Edwin Low	-	Head of Department/ Motor Vehicle Mechanic
46	Mrs Yap Chin Leong	-	Head/Academic Studies Unit
47	Kok Kok Lin	-	Head/Extra-Curricular Activities Unit
48	Mohd Yunos	-	Training Officer
49	Ng Chwee Chan	-	Training Officer
50	Chew Ek Soo	-	Training Officer
51	Tan Keng Siong	-	Training Officer
52	Lew Yew Tong	-	Training Officer
53	Ho Bee Heng	-	Training Instructor

Staff of Bukit Merah Vocational Institute

54	Jimmy Ho	-	Training Manager
55	Lim Seng Fatt	-	Head of Department/ Electronics Servicing
56	Tang Keng Yew	-	Head of Department/ Electrical Fitting
57	Miss Lim Bee Choo	-	Head/Academic Studies Unit
58	Eric Low	-	Head/Extra-Curricular Activities Unit
59	P A Hameed	-	Head/Administration Unit

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DW4/CR5 - Persons.Doc 4+

60	Ng Hung Jeng	-	Training Officer
61	Lee Khuang Choo	-	Training Officer
62	Foo Kok Suan	-	Training Officer

Approved Training Centre

Borneo Motors (S) Pte Ltd

63	Michael Koh	-	Manager/Training & Services

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DW4/CR5 - Persons.Doc 5

ELEMENTS OF CBE

Essential Characteristics

1. Competencies to be achieved by the learners are rigorously identified, verified, and made public in advance of instruction.

2. Criteria to be used in assessing achievement are explicitly stated and made public in advance.

3. The instructional program provides for the individual development and evaluation of each of the competencies specified.

4. Assessment of competency takes the trainee's knowledge and attitudes into account but requires actual performance as the primary source of evidence.

5. Learners progress through the instructional program, at their own best rate, by demonstrating the attainment of specified competencies.

Desirable Characteristics

6. Instruction is individualized to the maximum extent possible.

7. Learning experiences are guided by frequent feedback.

8. Emphasis is upon students' achievement of exit requirements.

9. Instruction is individually paced rather than time-based.

10. Instruction is field-centered using realistic work situations and actual on-the-job experiences.

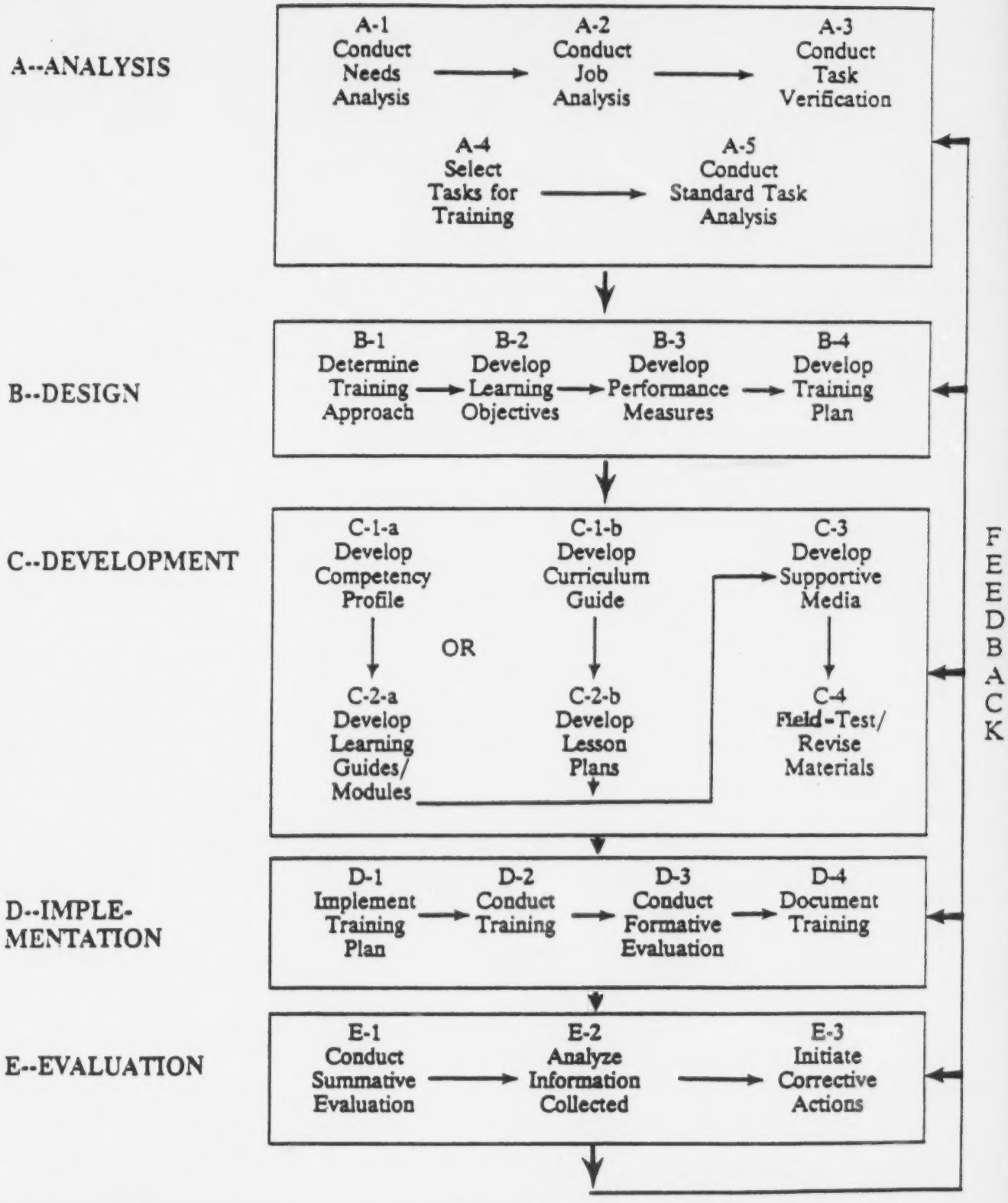
11. Instructional materials are:
    a. modularized
    b. mediated
    c. Flexible with both required and optional learning activities provided

12. The instructional program as a whole is carefully planned and systematic--evaluation data is used for program improvement.

PROPOSED CURRICULUM MODEL

MAJOR COMPONENTS

Annex H



SYSTEMATIC CURRICULUM AND INSTRUCTIONAL DEVELOPMENT (SCID)

Annex I

SCID

SYSTEMS APPROACH SUMMARY

Phases	Major Activities	Outcomes	Major Product(s)
Analysis	o Conduct Needs Analysis - Identify job needs - Identify company needs - Identify trainee needs o Conduct Job Analysis - Identify job/duties/tasks - Verify job tasks - Select tasks for training o Conduct Task Analysis - Identify steps - Identify knowledge needed - Identify safety factors/attitudes - Identify performance standards - Identify worker decisions - Identify tools, equipment & supplies and materials	o General Needs Identified o DACUM Chart or Duty and Task List o Task Verification Data o Tasks to be Included in Training Programme o Instructional Requirements for Each Task Including Specific Performance Standards	Training Programme Performance Standards
Design	o Determine Training Approach - Specify programme design - Specify entry requirements - Specify training settings o Develop Learning Objectives o Develop Performance Measures - Skill assessment - Attitude assessment - Knowledge assessment o Develop Training Programme Specifications - Facility needs - Equipment needs - Staffing needs	o Specification of Programme Design, Entry Requirements, and Training Settings o Performance and Enabling Objectives o Testing Specifications and Measures for Knowledge, Skill, and Attitude Assessment o Description of Facility, Equipment, Staffing, and other Programme Specifications	Curriculum Design Specifications
Development	o Develop Competency Profile o Develop Trainee Materials o Develop Supportive Media o Develop Training Officer/ Instructor Guide o Field-Test/Revise Materials	o Competency Profile o Learning Guides o Supportive Media o Training Officer/Instructor Guide	o Competency Profile o Learning Guides o Audiovisual Materials o Instructor's Guide
Implementation	o Implement Training Plan - Recruit/select trainees - Select and train staff - Secure needed facilities/ equipment - Schedule instructions o Conduct Training o Conduct Formative Evaluation o Document Training Results	o Students/Trainees o Qualified Staff o Required Equipment and Facilities o Training Schedule o Qualified Workers o Programme Improvement Data o Trainee Achievement Data	Competent Workers Training Programme Achievement and Improvement Report
Evaluation	o Conduct Summative Evaluation - Process data collection - Product data collection - Follow-up data collection - Cost data assembled o Analyze Information Collected - Compile data - Interpret data o Initiate Corrective Actions	o Summative Data - Process feedback - Product feedback - Follow-up data - Programme cost data o Description of Programme Improvements Needed o Programme Improvement Plan	o Programme Evaluation and Improvement Plan

/rk/WP51/CU1OKI - Annex(I)

Annex J

TASK ANALYSIS

Analyze Each Task to Identify:

1. **Steps/Activities Involved**
2. **Tools, Equipment, Materials & Supplies Used**
3. **Related Knowledge Required**
4. **Safety Concerns**
5. **Attitudes, (Behaviors) Involved**
6. **Performance Standards Expected**
7. **Decisions, Cues, & Errors**
8. **Other, as Desired/Required**

TASK ANALYSIS FORM

DUTY: _____ Date: _____

TASK: _____ Content Expert(s): _____

Recorder: _____

Steps	Standards (How Well)	Tools, Equipment, Materials, & Supplies	Related Knowledge	Safety	Attitudes

DECISIONS	CUES	ERRORS
Identify Decisions that Must be Made	Identify the Data Needed for Making Correct Decisions	Indicate What Will Result if Incorrect Decisions are Made

COMPENTENCY-BASED EDUCATION AND TRAINING: A Humanistic and Realistic Approach to Technical and Vocational Instruction

Introduction

When teachers and administrators are asked to consider changing their instructional programs from the conventional lecture-discussion approach to the competency-based education (CBE) approach, they logically and quickly ask, why is it really better? Many persons have already concluded that it is indeed better because they feel that it permits more students to reach a higher level of attainment and that it is especially suitable for special/exceptional students who have not experienced success in regular programs.

Before going further, let's look at what some of the authorities are saying about CBE. The National Academy of Sciences, in a report released in 1983, stated--

> Unions, educators, and employers should work to change the requirements for the completion of cooperative education and apprenticeship programs; they should be based on competence rather than time. This change will be fraught with difficulties and will require the expenditure of considerable money and time, but we believe it is extremely important. . . . The difficulties in deciding what competencies should be included, deciding what levels of skill are required, and determining how to measure these abilities are not to be underestimated.[1]

Gary Warner, speaking on behalf of the Associated General Contracters (AGC) of America before a subcommittee of the U.S. House of Representatives, stated--

> AGC believes that construction craft training programs must follow a competency-based approach with each individual progressing at a rate commensurate with a demonstated ability to perform, as opposed to a specified length of time.
>
> Aside from establishing a more efficient vehicle for construction training in general, competency-based instruction provides a better means to facilitate the entry of females and minorities into the industry. With certified skills attained over minimal periods of time, females and minorities can represent to the construction contractor an available manpower resource which can be based on skills and not arbitrary quota requirements established by the federal government. Having been evaluated against performance standards, such a manpower pool represents trained craft workers capable of functioning on a job site and seeing a

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1. Susan W. Sherman, ed. Education for Tomorrow's Jobs. Washington, DC: The National Academy of Sciences, National Academy Press, 1983.

project to completion. Competency-based training also permits the varying rates of advancement necessary to maintain the enthusiasm of the lower-than-average and the faster-than-average trainee.[2]

Dr. Daniel Lyons, Director of Training for the Goodyear Tire and Rubber Company, speaking before the same U.S. House of Representatives subcommittee, stated--

> We believe that the critical, central issue in apprenticeship training is that the wasteful, medieval concept of time-based training must be discarded in favor of competency-based training. . . . The student proceeds through the training on the basis of demonstrated competency rather than on the basis of elapsed time. The superiority, validity, and practicality of competency-based training has been thoroughly and repeatedly demonstrated and documented in technical training throughout industry and the military services.
>
> The Goodyear Tire & Rubber Company is totally committed to competency-based training. Several years ago we decided that we would no longer participate in time-based apprenticeship programs.
>
> It is obvious that time-based traditional programs, which extend training time far beyond that which is necessary to acquire required skills and knowledge, are inefficient and wasteful of financial resources and human talent. U.S. business and industry, engaged in increasingly severe and sophisticated global competition, cannot tolerate this waste. What may not be so obvious is that competency-based training programs consistently produce graduates who are better qualified than those from traditional time-based programs.[3]

Given these comments, which should stimulate any educator's interest in looking at CBE more closely, let's look at what makes CBE so different. To understand what CBE really involves, we will look closely at the following four major subtopics:

- Defining Competency-Based Training
- Identifying Training Program Needs
- Developing the Curriculum
- Developing Competency-Based Instructional Material
- Developing Competency-Based Education/Training

---

2. Gary Warner. A statement made on behalf of the Associated General Contractors of America before the Subcommittee on Employment Opportunities of the Committee on Education and Labor, United States House of Representatives, November 17, 1983.

3. J. Daniel Lyons. A statement made on behalf of the Goodyear Tire and Rubber Company before the Subcommittee on Employment Opportunities of the Committee on Education and Labor, United States House of Representatives, November 17, 1983.

Before proceeding, it should be noted that terms and acronyms for these programs abound: CBE, CBI, PBE, PBI, CBVE, CBVI. What is important is that all such programs, regardless of the specific names attached to them, should possess the essential and desirable characteristics described below in order to be considered truly competency- or performance-based.

Defining Competency-Based Training

To comprehend fully the meaning of CBE, one must be aware of the essential elements and desirable characteristics of such programs. There are five essential elements:

1. Competencies to be achieved are carefully identified, verified, and made public in advance--This simply means that the important entry-level competencies for any occupational program area must be identified in some appropriate manner, verified as relevant by experts who know that field, and then made known to students and everyone else interested in what the program is designed to teach.

2. Criteria to be used in assessing achievement and the conditions under which achievement will be assessed are explicitly stated and made public in advance--This means we are going to eliminate guessing games about what parts of the course are important and tell students exactly how their performance will be evaluated. The implementation of this essential element also means that we are giving up the traditional norm-referenced approach to the evaluation of student achievement in which the focus is on comparing a student's progress with that of other students. In its place, we are adopting the criterion-referenced approach in which each individual student's progress is compared with previously established criteria that are made known to all who are concerned.

3. The instructional program provides for the individual development and evaluation of each of the competencies specified--What we are saying here is simply that each student shall be given the opportunity to develop each of the competencies important to his/her training program, and that each student will be given the opportunity to demonstrate attainment of each competency. This essential element has strong implications regarding the need to individualize CBE programs to the maximum extent possible and for the type of instructional materials needed to make individualization possible.

4. Assessment of competency takes the students' knowledge and attitudes into account but requires actual performance of the competency as the primary source of evidence--CBE goes beyond the traditional educational expectation that students should know the "how" and "why" of things and places a strong emphasis on the "ability to do" as well. Of course, in order to perform a task correctly, the student will need to acquire the necessary prerequisite knowledge and attitudes.

Acquiring the necessary prerequisite knowledge and attitudes involved, however, does not by itself ensure the student's actual ability to perform important competencies.

It is with regard to this essential element of CBE that many programs fall short, relying instead only upon paper-and-pencil tests of cognitive understanding as proof of competency. While such measures can appropriately be used to assess prerequisite knowledge, they must be supplemented by performance-oriented, process-and-product checklists or other measurement devices that permit assessment of the student's actual ability to perform the expected competencies.

5. Students progress through the instructional program at their own rate by demonstrating the attainment of specified competencies--Said in another way, we want to make time the variable and learning the constant. Again, it is clear that some individualization of instruction is called for. While student progress is dependent upon the demonstration of competencies, this element does not mean that reasonable time limits cannot be imposed upon the students. Some persons may want to interpret this element to mean that only the student is accountable for his/her progress. Not so--a CBE program places accountability for learning squarely upon the shoulders of both the learner and the instructor.

In addition to the five essential elements of CBE programs, there are a number of facilitating or supporting characteristics. These can be grouped into instructional characteristics and administrative characteristics. These facilitating characteristics help bring the potential of CBE into full reality. They allow students to learn efficiently and instructors to teach effectively. They make vocational education more rational and relevant than ever. A vocational-technical program is considered to be fully competency-based when it exhibits most of the characteristics listed in the following two facilitating categories.

Facilitating Instructional Characteristics

The instruction is designed to include the following instructional elements:

- The instructional materials used (e.g., learning guides or modules) are keyed to the competencies to be achieved.
- Environments that duplicate or simulate the work place are available to students during competency development.
- Basic knowledge or background theory is learned as it is needed to support competency development.
- Students are informed about the traits and attitudes important to workers in the occupation and are periodically evaluated regarding their attainment.

- Each student is given continual and detailed feedback on competency development.
- A variety of learning styles and teaching strategies are provided for.
- Students with appropriate prerequisite skills and knowledge may bypass instruction on competencies already attained.

Facilitating Administrative Characteristics

The program is organized and supported administratively to include the following elements:

- Program completion is based on satisfactory achievement of all specified competencies.
- Students can enter and exit from the program at different times.
- Individual student records are maintained and reflect student progress at any given point in time.
- Materials, space, and equipment are available when needed by students and instructors.
- The record-keeping system permits student transfer into and out of the program without requiring duplication of instruction on competencies already achieved.
- The requirement of a designated number of hours of instruction is removed from the criteria for program completion.
- Records of competency attainment are provided to students and prospective employers.
- Student grades, if used, reflect the level of competency achievement attained.
- Credit, if awarded, is given for competencies achieved as a result of instruction and for demonstration of previously acquired competencies.
- Student fees are individually assessed and are based on the time actually spent in the program and the instructional resources used.

When we add the facilitating characteristics of CBE to the five essential elements, the graphic presentation looks like the one shown on the following page.

Thus, the facilitating characteristics support and enhance the potential inherent in the whole CBE process. While the five essential elements must be established with all due rigor and without compromise, it is in the facilitating characteristics that program individuality and adaptability come in. The logic of the facilitating characteristics is so clear that most vocational administrators and instructors can accept them in principle without difficulty.

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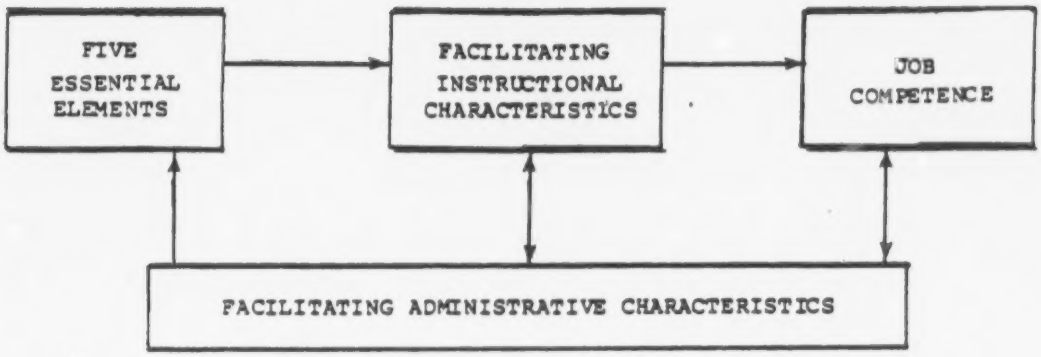
ESSENTIAL ELEMENTS AND FACILITATING
CHARACTERISTICS OF CBE



For a graphic illustration of what CBE means to the student functioning in such a program, see Attachment A. Another model illustrating how a student may enter, exit, and re-enter a CBE program is illustrated by Attachment B. When implementing CBE, considerations must be given to modifying the traditional instructional and administrative processes so as to facilitate the movement of students through this type of learning and evaluation sequence.

Advantages of CBE

The underlying concepts of CBE are considered by many to be extensions and elaborations of the mastery learning concept proposed by John Carroll[4] in the 1960s and Benjamin Bloom[5] in the early 1970s. Their thinking is substantiated by research results that show that, given favorable learning conditions, most people can learn almost anything. If this seems farfetched, consider the automobile. Here is a fearsome, powerful, and complex machine. Yet practically every adult American has learned to drive it at high speed on the highway, though some of them may not have learned how to read or write or do simple arithmetic. The difference is that in learning to drive they had motivation and favorable learning conditions.

When you accept that most people can learn, then it is difficult to be satisfied with the "normal curve" of instruction in which a certain percentage of students are expected to fail or do poorly. Instead, you teach for success

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4. John B. Carroll, "A Model of School Learning," Teachers College Record, 64 (1963): 723-733.

5. Benjamin S. Bloom, Human Characteristics and School Learning (New York, NY: McGraw-Hill, 1976).

and expect every student to achieve each required skill before moving on to the next one. To be sure that competency is achieved, you change the learning conditions if necessary; you do not eliminate skills or try to change the students.

The traditional view of learning is that there are good learners and poor learners. In this view, the individual's ability to learn is considered to be a rather permanent trait, and a student's position on the normal curve is expected to remain fairly constant throughout school. Based on this traditional view, the important task of a school or college would be to teach those that can learn and weed out those that can't.

A more recent idea is that there are faster learners and slower learners. Much educational effort has been expended to provide slower learners with the extra time and special help they need in order to achieve. Individualization of instruction and extended laboratory time are examples of the ways instructors have sought to meet the needs of slower and more rapid learners. It has become evident that slower learners can ultimately meet the same criteria as faster learners, and they seem to be able to learn equally complex and abstract ideas--if given the necessary time to do so.

Bloom's recent research has led us to the view that, given favorable learning conditions, 95 percent of people can learn almost anything. In addition, the mastery learning principle contends that most students become very similar with regard to learning ability when provided with favorable learning conditions. The term favorable learning conditions is, of course, the crucial element. This may include extra time, additional instruction, a variety of instructional media, or field-based learning experiences, among other things.

This means that educational institutions should provide for a variety of student learning styles and rates, that students should demonstrate competence in one skill before moving on to another, and that instructors must be able to deal with students as individual learners rather than as members of a large group. It also implies that subject-matter content must be carefully identified and organized. In short, it leads to competency-based education. A brief summary of how CBE can benefit the major participants and the community--student, teacher, administrator, and business, industry, labor--is shown on the next page.

There are also significant benefits associated with CBE in the area of educational administration and management. These benefits are virtually automatic when you install this approach. Among the most important are the following:

- Students with a wide range of entering skills can be accommodated.
- Facilities and work stations can be used more fully.
- Program completers can be placed in jobs more readily because they enter the job market all through the year.

CBE BENEFITS

Student

- The learner will achieve competencies required for employment.
- Learners progress at their best pace to achieve occupational skills.
- A wide range of abilities can be accommodated within a program.
- The learner builds confidence by succeeding in learning.
- The presentation of content is more consistent.
- More learning options are available to all students.
- The learner is presented with a transcript of the competencies achieved.

Teacher/Instructor

- Time is used more efficiently and effectively as a leader or manager of the learning process rather than a "provider of information."
- More time is spent working with students individually and in small groups.
- Less time is required to prepare and make lectures.
- Less time is required to develop and grade paper-and-pencil tests.
- More time is spent evaluating students ability to perform essential occupational skills.

Administrator

- Instructional staff can be used more efficiently.
- Building and instructional equipment can be used more efficiently.
- Placement of graduates in jobs is assisted.
- Students with a wide range of entry-level skills, including handicapped, can be accepted.
- Articulating secondary, postsecondary, and part-time adult instructional programs is easier.
- Satisfaction of seeing students achieve their goals.
- Greater support of training programs by business, labor, and industry.

Business, Labor, and Industry

- Optimum involvement in the identification of competencies to be learned by the student.
- More substantive involvement of industry experts in establishing performance criteria and other industrial expectations.
- Availability of potential employees trained in the skills required on the job.
- Better collaborative and more trusting relationships with the schools/colleges.

- The business community is substantively involved in the institution's programs because they are participants in the competency identification process.
- New programs can be readily set up; existing programs can be easily revised and kept current.
- The instructional staff can be used more effectively because they have more time to work with individuals and small groups of students.
- Capital outlay funds can be used more efficiently because it is not necessary to have so many duplicate tools and equipment.
- Students with special/exceptional needs can be accommodated into regular vocational programs by selecting competencies according to their specific needs and abilities.
- Part-time instructors can be used efficiently when the CBE program and materials are in place.
- Program continuity can be maintained even as staff members change.

Related to the management benefits of CBE are the educational benefits to students. Among the most important educational benefits are the following:

- Each learner can progress through the program at his/her best rate.
- Each student can learn using his/her preferred learning style.
- More learners achieve competence than in comparable conventional training programs.
- Learners with little previous educational success build self-confidence and self-reliance by succeeding in a CBE program.
- Students learn to cooperate rather than compete for grades.

Implementation Requires Training and Resources

That CBE will probably cost more to establish and operate is probably best described as an honest misconception. There is no doubt that it will cost money to establish a CBE program. Several types of start-up costs are involved, including the need to provide for (1) the time of faculty and administrators involved in the program planning and development process; (2) the inservice education of all staff about all aspects of CBE curriculum, instruction, and program management; and (3) the purchase or development of instructional media and printed materials. It is highly questionable, however, that these initial development costs are any more than they would be to begin any other type of new program.

As regards operational costs, there are likely to be some increased expenditures. More support staff may be needed to manage the large variety of printed and audiovisual materials used. If learning guides or other printed materials are produced in-house, this will result in the use of more paper supplies. Increased use of consumable materials in shops and laboratories

is also likely because of the repeated practice required for all students to achieve competence.

However, there will also be some savings on operational costs. Probably the major savings will result from the thousands of dollars that can be saved on major equipment. In a lockstep, conventional welding class, for example, most if not all the students would need to have access to arc welders at the same time--hence the need for 10 to 15 welders, which would be used used only part of the year. With CBE, three welders may be enough, because class members will be learning those skills at different times as they learn at different rates or take different "paths" through the program.

One element that characterizes institutions that have successfully implemented CBE, however, is consistency. Regardless of how you decide to approach instructional delivery, it is highly recommended that the approach be common to all programs. While flexibility and creativity are still possible, some uniformity facilitates student and instructor adjustment to CBE.

Staff Orientation

When the elements of your instructional delivery system have been determined, you must initiate the crucial step of staff orientation. Inservice training on each aspect of your CBE approach will be necessary. Small-group instruction or one-on-one assistance seem to be the most effective training strategies to use. If resources permit, establishing a CBE staff resource center that houses materials on CBE development and implementation is an excellent idea. Visits to CBE programs, attendance at CBE conferences, and enrollment in courses on CBE are other viable staff development options. As you develop your long-range CBE plans, do not neglect to allocate funds and resources for staff development. No matter how effective your plan looks on paper, it will be you and your staff--working together--who will make CBE succeed.

Identifying Training Program Needs

It is often said that if you don't know where you want to go, any route will get you there, even though you probably won't know when you have arrived. Take the case of the airline pilot who announced to his passengers over the public-address system, "I've got some good news and some bad news. First the bad news: We're lost! Now for the good news: We're making very good time!"

Needless to say, successful airline pilots and ship captains use maps and various tools to plan their routes so as to ensure that they will arrive at their predetermined destination quickly, safely, and as economically as possible. In a like manner, vocational-technical administrators at all levels must understand and effectively use the tools and techniques of educational program planning. Without effective planning, the predetermined United States legislative goal of "strengthening and expanding the economic base of the

Nation, developing human resources, reducing structural unemployment, increasing productivity, and strengthening the Nation's defense capabilities by assisting the states to expand, improve, and update high-quality programs of vocational-technical education"[6] is not likely to be achieved.

One state director of vocational education describes the role of the local administrator in planning this way:

> Perhaps the most important work that an administrator does is to plan for the future. If planning is well done, then the execution of the program can be accomplished with a minimum of problems. Probably what is more important is that the program will meet the needs that the administrator has perceived.[7]

The word planning means different things to different people--some react positively (who can be against it?) and some react negatively (who's got time for it?). Planning may be defined simply as the intentional, rational process of devising a future course of action. Planning is nothing more than preparing for the future, whatever form that preparation takes. All individuals who survive for any length of time do it.

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6. Carl D. Perkins Vocational Education Act, U.S. House of Representatives, October 2, 1984.

7. Local Educational Agency Vocational Education Program Planning Guide (Charleston, WV: State Department of Education, Bureau of Vocational, Technical, and Adult Education, n.d.), p. 1.

Identification of Programs and Services Needed

This activity involves the identification of the vocational programs and services needed, using (1) all the information that has been gathered about community, individual, and labor needs; and (2) the data obtained from the analysis of existing programs and services. The pulling together of all the major data inputs in order to arrive at a documented list of the vocational programs and support services needed is illustrated on the following page.

This activity has been described by some planners as a type of "discrepancy analysis." The analysis of the community, individual, and labor needs data results in a description of "what ought to be," while the analysis of existing programs and services results in a description of "what currently is." Wherever a gap exists between "what is" and "what ought to be," it may be said that another need or problem still exists. Once these problems or unmet needs are identified and documented, they can be prioritized, and recommendations can be made for alleviating them. At least four types of recommendations may be the product of this problem-solving activity. These recommendations will normally include the following:

- Recommendations concerning what programs and services should be continued as is
- Recommendations concerning what programs and services should be modified
- Recommendations concerning what programs and services should be discontinued or phased out
- Recommendations concerning what new programs and services should be added

The identification of needs or problems should not be viewed as criticisms of the current programs and services, but as deficiencies that should help planners and decision makers plan vocational education programs that will better serve the needs of the institution's clientele.

Developing the Curriculum

No single curricular element is more important to establishing a CBE system than the careful identification of competencies. Regardless of the instructional delivery methods used, to be competency-based a program must be based on the competencies (tasks) identified by successful workers in the occupation through a valid occupational analysis process. While several valid approaches are available, you must decide which approach is most acceptable.

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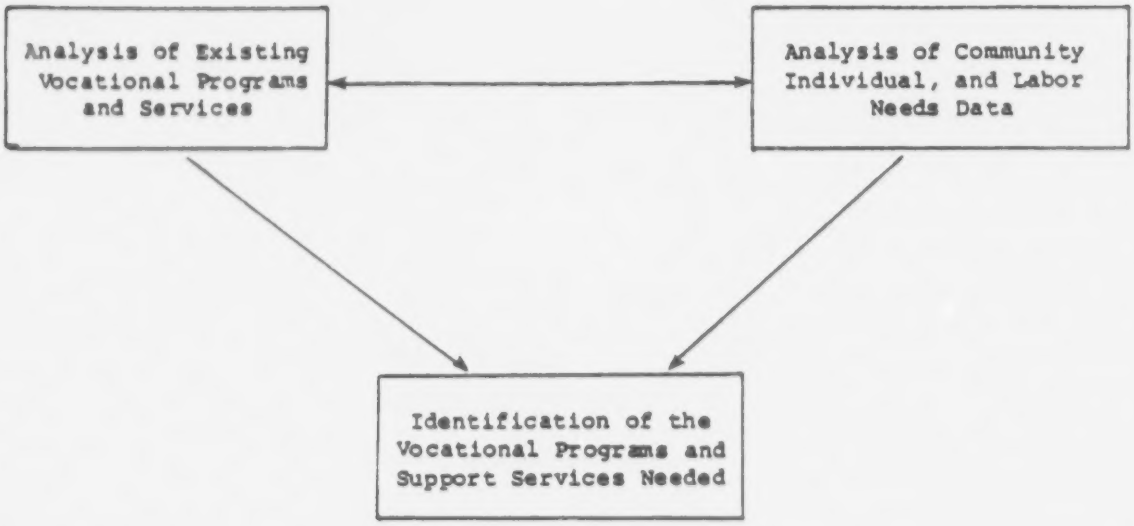
RELATIONSHIP OF MAJOR DATA INPUTS
TO PROGRAM PLANNING



Competency Identification

One approach to competency identification that should be considered unacceptable is allowing the teachers or instructors to identify the competencies themselves. Either occupational analyses that have been appropriately developed elsewhere should be obtained and verified locally, or local analyses involving the input of expert workers from business and industry should be conducted.

Not only must the competency identification process be valid, it must also be appropriate for local conditions and needs. Although many occupations do not differ nationally from region to region, others do, and those differences must be taken into account. While competency lists are widely available, they must be carefully reviewed to determine their applicability to local conditions. Providing for local "ownership," particularly by instructional staff and area employers, is an excellent way to ensure meaningful use of each competency list. Unless staff and local employers endorse the competencies, the competency list will likely end up as nothing more than a wall decoration.

In the United States, valid competency lists for a variety of vocational programs are available from several sources, among them the Vocational-Technical Education Consortium of States (V-TECS), the six Regional Curriculum Coordination Centers, and many state-department-supported curriculum laboratories. Although these resources are readily available--and at

relatively low cost--it is recommended that they be subjected to local verification by a program advisory committee or local incumbent workers.

When existing competency lists cannot be located or appear to be inadequate or inappropriate, another option for competency identification is DACUM (Developing A Curriculum). Begun in Clinton, Iowa, in the late 1960s, the process has been used extensively in the United States and Canada. DACUM, involves 8 to 12 local expert workers in a structured brainstorming session for 2 or 3 days to generate a comprehensive list of worker duties and tasks.

The Center has further developed and refined the original process by adding a number of quality enhancement procedures. The Center has developed a DACUM Handbook and regularly conducts DACUM Facilitator Institutes to train persons as certified facilitators.

While DACUM is an excellent means of identifying valid competencies and securing a feeling of local ownership, the process requires careful planning. Typically, instructors identify expert workers in the area, and companies are contacted and requested to release workers for the two- or three-day session. Contacts with local business people can be invaluable in helping to secure DACUM panel members. In addition, an experienced DACUM facilitator, skilled in group dynamics and the DACUM procedure, must be secured to conduct the analysis session.

As an administrator, you must weigh the relative costs and feasibility of each of these methods against the outcomes and potential gains of each. As always, program instructors and department heads should be involved in this decision-making process. However, you must consider the impact of selecting one competency identification procedure over another and the impact of using several different approaches, with products that vary in format, wording, and scope. For more about DACUM, see Attachment C entitled "A Tool for Developing Curricula."

Task Verification

Verifying the occupational tasks confirms that the items listed in fact describe the occupation and, specifically, the local occupational situation into which students will be placed. To structure the verification process, certain decisions must be made: (1) who will conduct the verification, (2) who will participate in the actual verification, and (3) what questions will be asked. In all likelihood, during the decision-making stages, there should be major involvement of three parties: (1) an administrator, (2) staff responsible for conducting the verification (e.g., those designated as curriculum developers), and (3) advisory committee members.

A member of the administrative staff must be involved to set up initial meetings with verification staff and advisory committee members. It is the administrator who must explain to the group what decisions must be made and what and how they can contribute.

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Staff who will conduct the verification should be involved. Again, if staff are to believe in and use the results of curriculum development, they must understand its importance. Their being involved throughout the development process will help them feel a part of this important procedure and greatly enhance articulation between academic and vocational program areas. Since they have been workers in their field, their inputs are critical.

Advisory committees must be involved. In the United States, advisory committees have become a part of vocational education at both secondary and postsecondary levels. The advisory committee for a particular service area and the program advisory committee or craft committee are groups of citizens with expertise in the world of work who are appointed in order to provide vocational instructors with advice concerning preparation of students for employment. As such, they have a key contribution to make to curriculum development, especially to its articulation with other programs and activities. They can provide suggestions concerning what verification questions should be asked, what techniques would secure the most cooperation from employers asked to participate in verifying the analysis, and what employers should be involved. They can also participate themselves in the verification of the list. Clearly, if your occupational program has no advisory group, one of your first steps is to appoint such a body.

At the planning meetings involving these persons, the following decisions will need to be made, with input from all members of the group:

Who will conduct the verification process?

- A member of the administrative staff, such as an evaluation specialist
- A specially appointed and trained group of faculty
- A previously appointed staff, such as a team of curriculum developers
- Other personnel

What questions will be asked?

- If you want only to verify the skills as real and relevant, you can ask incumbents simply to review each item on the analysis and check it if it is actually performed as part of that job.
- If you wish to gather other information relevant to sequencing and curriculum development, your verification instrument or interview could include other questions such as (1) Is the task performed by beginning workers? (2) How often is the task performed? (3) How important is the task? and (4) How difficult is it to learn to perform the task? Some other task rating options are listed in Attachment D.

Who will be asked to verify the tasks?

- Employees (incumbent workers in an occupation)
- Immediate supervisors of such workers
- Employers locally who hire workers in this area
- Advisory committee members

What key activities need to occur and what will be the schedule for their completion?

- Design of instrument or questionnaire
- Pilot test of instrument
- Contacting of respondents

You must ensure that whatever verification process is selected is feasible--and effective--within your budget. Once the decisions have been made, your role is that of facilitator--making sure any necessary forms are processed through your office quickly, being aware of the progress being made, and furthering that progress where possible. If some verification is to be done through interview/observation techniques, you can facilitate that process through such devices as providing the means for training the interviewers, or writing letters of introduction over your signature to help interviewers gain the cooperation of employers. At any rate, the point is that, even though verification will probably not be your direct responsibility, you will need to understand the process, help with the decisions, and monitor progress if you want a good job to be done.

Conducting Task Analysis

Each verified task statement needs to be analyzed--to be broken down into at least the knowledge, skills, and attitudes required to perform it. This step serves several very important purposes, one of which is to provide teachers with a more detailed basis for developing instructional materials. More importantly, however, it helps the curriculum developer(s) to identify the relative "size" of the competencies listed. No matter how carefully defined and structured the analysis process has been, competencies inevitably vary in size, i.e., in the amount of time and effort required to teach or to learn that skill. By analyzing each competency, one can identify and remedy these inconsistencies.

It is helpful to provide curriculum developers with a simple chart to use to structure the completion of this step (see Attachment E). Using such a chart, one can analyze each competency to determine (1) the steps involved, (2) the cognitive (knowledge) elements involved, and (3) affective (attitude) elements involved.

Often times, a more complex form (see Attachment F) is being used for technical, supervisory, and managerial tasks. It requires analyzing each verified task to determine (1) the steps involved, (2) the tools, equipment,

materials, supplies, people needed, (3) safety factors, (4) related knowledge (math, science, language) required, (5) the attitudes that are important, and (6) the decisions the workers must make, and (7) the performance standards expected. In some cases we are also identifying all the decisions that must be made by the worker, what cues the worker is given to aid in the decision-making process, and the errors that will result if incorrect decisions are made.

Developing Competency-Based Instructional Materials

Although the use of individualized learning packages is not an essential element of CBE, most fully functioning CBE programs have recognized the potential of this approach for focusing on the individual development and evaluation of the specified competencies for each student.

This means that, in a CBE system, the instructional development process generally moves directly from the identification, analysis, and clustering of competencies to the development (or selection) of learning packages and strategies to deliver on those competencies. The conventional approach--involving as it does more emphasis on content areas and group instruction within specified blocks of time--moves instead to the development of overall plans for a course or program (the course of study), and then to unit and lesson plans.

In many institutions, individual instructors are given total responsibility for developing, continually updating, and revising the learning packages students will use. Given a list of the competencies to be achieved by students, they decide how each competency will be taught--what prerequisites are required, what instructional strategies will be employed, what criteria will be used to evaluate student performance. These decisions are used to organize the content of the learning packages.

In other institutions, particularly when more than one instructor will be using the materials, the development of learning packages is a team effort. An efficient and productive materials-development team consists of an educational technologist, a typist, and one or more instructors. With CBE, a new teacher may "inherit" from another instructor, not a course of study and series of lesson plans, but a list of competencies and a series of learning packages.

Although some states and districts are developing (and making available) CBE materials in some occupational areas, high-quality materials do not presently exist in all occupational areas. Thus, it is more than likely that staff involved in competency-based instruction will need to develop their own learning packages or at least work with others in a team effort. To assure the production of high-quality, usable, effective materials, you will need to provide funds and staff time for the development effort and ensure that staff have the needed training. Some institutions schedule workshops and bring in outside consultants with expertise in CBE and the development of learning packages.

There are at least two types of learning packages, with some definite advantages and disadvantages inherent in each. Learning guides are simple materials. They are reusable paks containing directions for learning activities and explaining where to go for needed resources. They may be developed relatively quickly by school personnel, and they are fairly inexpensive to reproduce. Obviously, their effectiveness is dependent upon the quality and availability of the support resources to which they refer. See Attachment G for a suggested format, selected components, and some development guidelines.

Modules, which are basically self-contained, transportable, and consumable in nature, have the advantage of being completely under the control of the developers. The instructional content and approach can be tailored to meet the particular needs of the program, and few outside resources are needed. Self-contained modules, however, can be very time-consuming and expensive to develop, and they demand greater expertise in their production. Most CBE programs are now using learning guides, adding some instructor-produced instructional materials to enhance the learning activities.

Assessment Procedures

As an administrator in a school or college that has implemented CBE, you set the tone for a productive, positive learning environment. Assessment of student knowledge and performance is one of the most difficult and potentially divisive issues in CBE. Before any instructional or organizational changes are made regarding assessment, you would be wise to examine your own assumptions about student assessment and to lead your staff in reaching consensus on a philosophy of student evaluation. In conventional educational systems, evaluation is based on a cumulative average of work done in a term or semester. In CBE programs, evaluation is based on successful attainment of individual competencies and on the ability to integrate the proper combination of those competencies in actual or simulated job situations. In conventional systems, a student's grade is affected by the accomplishments of his/her peers (norm-referenced). In a CBE system, students are rated according to occupational standards of performance (criterion-referenced).

Most CBE programs provide for students to first rate their own performance against established criteria. Once a student is satisfied that he or she can meet the criteria, then the instructor is asked to evaluate the performance. If the student's ratings are confirmed by the instructor's evaluation, the student can move on to work on another competency. If, according to the instructor's evaluation, the student cannot yet perform the skill successfully, the student continues to study and practice until competence is achieved.

In conventional systems, learning time is constant and achievement is variable. In a CBE system, learning time is variable and a student must achieve an acceptable level of proficiency on each skill.

Although existing institutional procedures and regulations may make it difficult, if not impossible, to conduct a truly competency-based approach to assessment, adopting a philosophy or approach to evaluation that is student-centered and competency-based will enhance the functioning of your CBE program, even in a conventionally organized institution.

Occupational Skill Competency-Testing

The growth of competency-based education has brought with it the need to provide standardized measures of student performance in vocational-technical programs and the proliferation of occupational tests developed to achieve that end. Federal criteria for evaluating vocational-technical programs and numerous state mandates to install performance based vocational achievement measures by specific target dates have spurred test development even more.

Today in the United States tests are being developed at all levels, from individual programs and local education agencies to state departments of education and consortia of states and agencies. It goes almost without saying that "wheels" are being reinvented many times over as developers seek to produce tests for programs that are quite similar. Understandably, there is increasing interest among developers in taking advantage of one another's efforts and building upon existing materials and measures.

In order to avoid great duplication of effort, programs undertaking test development need to be aware of existing resources and to obtain certain information about them:

- What tests or item banks already exist?
- What other projects are currently planned or underway that might parallel or overlap with local efforts?
- Which products have been systematically developed and verified?
- What systems have been established for developing and verifying test items?
- What mechanisms exist for sharing information and products?
- What testing-related services exist that might meet local needs?
- How can specific products or services be obtained?

Test Types and Features

A variety of test products and services are available, as follows:

Occupation-specific tests. Many occupation-specific tests have been developed in all program areas of vocational education and a wide range of postsecondary-level programs. Developed from occupational task lists, tests include criterion-referenced items that have been verified as representative of the competencies required of a worker in the occupation. These tests are usually keyed to locally developed task lists and/or broader item-bank

systems. They are most often shared in "hard copy" (paper) form, although some have been or are being placed in computerized systems that provide for on-line student assessment.

Item banks. Item banks, as denoted by the name, are collections of individual test items from which tests can be created. Stored by computer and keyed to task lists, they may be used to assemble item sets or to custom-design tests. V-TECS has the largest vocational test item bank, although some states are creating their own banks of items developed originally on paper.

Cognitive tests. By far the majority of competency-based tests are measures of cognitive achievement. Multiple-choice items predominate on cognitive tests and item bank entries, with a few true/false items mixed in. Cognitive tests may be paper-and-pencil or on-screen computer-based instruments.

Performance tests. A few projects have developed performance tests designed to measure achievement of psychomotor skills. Usually these are either (1) product or performance mastery checklists or record sheets or (2) work assignments designed to sample manipulative skills in the occupation. In either case the tests include criteria for evaluating student performance. Test props in some cases are provided as part of the package; in others they are listed and must be provided by the agency that uses the tests.

Affective measures. This aspect of evaluation seems to have received the least amount of emphasis. Work habits inventories are available for some programs; otherwise, specific items related to work attitudes items are sometimes included in either performance checklists or cognitive tests.

Selecting Tests For Local Use

When selecting items or tests for use in a local use, the questions of quality, appropriateness, currency, local relevance, convenience, and usefulness should be considered.

High-quality tests have the following characteristics:

- Validity and reliability. Good tests measure what they are intended to measure and they do so consistently. Tests and test items that have been developed by trained item-developers, reviewed by experts, validated in terms of importance to the occupation, and field tested with large numbers of students have a greater chance of being valid and reliable.
- Criterion-referenced. Criterion-referenced tests assess ability in terms of predetermined criteria which in turn are based on realistic occupational behaviors. (Norm-referenced tests, by contrasct, assess ability in relation to other students' performance.)

- Appropriateness. Tests should use appropriate evaluation methods for the types of objectives to be measured. Written, multiple-choice items, for example, can provide an effective measure of cognitive achievement (occupational knowledge). Only in limited cases (e.g., an occupation like bookkeeping, in which the job skills can be realistically simulated on paper) would paper-and-pencil tests effectively measure psychomotor achievement (job skills). Performance tests generally provide the best measure of psychomotor achievement.

- Currency. As occupational practices change, so must the related curricula, and evaluation instruments. A test that was carefully developed 10 years ago in a technological field is likely to bear little resemblance to current job requirements and performance standards for the occupation. Task lists and tests must be reviewed on a regular basis and updated as necessary to ensure that they reflect current competencies and performance standards for the occupation.

- Local relevance. No matter how carefully a test has been developed, it will not be useful unless it represents locally relevant occupational goals and objectives. Any test materials acquired from other sources should be carefully examined with this in mind and adapted, as necessary, to local conditions.

- Convenience and usefulness for local purposes. There are many factors to be considered in relation to convenience and usefulness. Many of these have already been discussed. Generally speaking, the questions to be answered are whether local needs will be best served by obtaining outside materials and which particular materials best meet those needs.

Summary

Whether you are implementing your own CBE program, helping another teacher or instructor implement such a program, or in the position of evaluating programs implemented by others, some means of formative evaluation can be very helpful. With the essential elements and the desireable characteristics in mind, a Competency-Based Education Program Evaluation Checklist (see Attachment H) has been devised to help you assess the status of any CBE program. It is recognized that different states and countries have somewhat differing philosophies about what CBE is and, hence, the checklist may have to be modified somewhat to fit local philosophies. Nevertheless, it is felt that the criteria listed reflect the minimum essential program elements that are generally recognized as necessary to assure overall program quality. It is hoped that the instrument can be used in a positive way to promote further the implementation of high-quality CBE programs that will better meet the vocational and technical education needs of our youth and adults.

The extensive work and resources that went into the development of our (a) 132 performance-based teacher education (PBTE) modules, (b) 34 competency-based administrator education (CBAE) modules, (c) 34 competency-based career guidance modules, (d) 54 enterpreneurship modules, and (e) our DACUM Handbook

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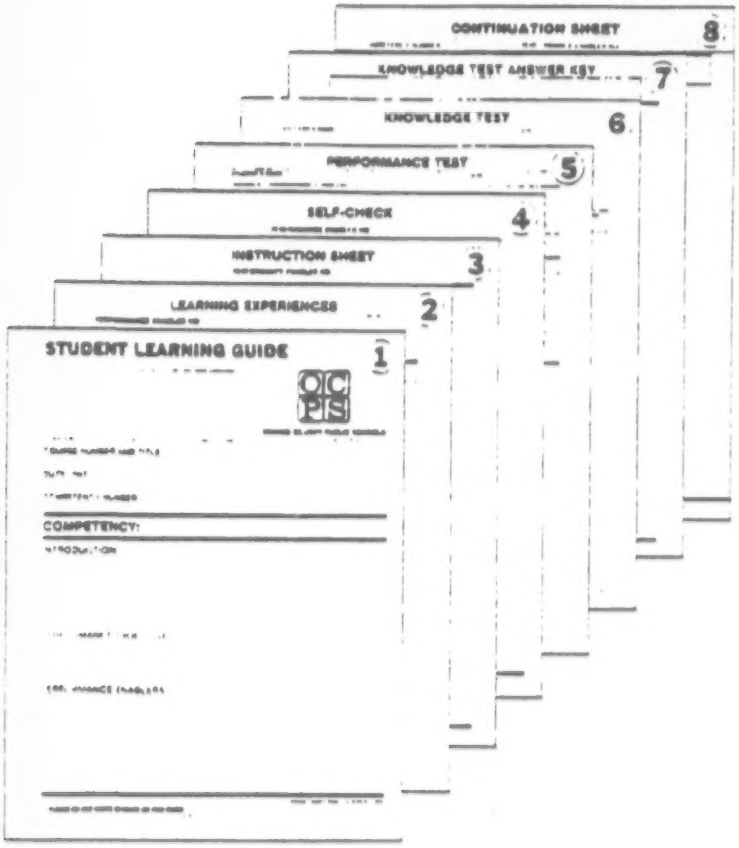
should give you a feeling of the major importance that the Center attaches to this innovative and rapidly worldwide growing curricular approach to technical and occupational education. CBE--the most humanistic and realistic approach to occupational education devised to date--is here to stay. The challenge to implement CBE and improve our programs by so doing is ours to accept. We ;at the Center stand ready to help any state, country, or person who wants to move ahead with CBE.

STUDENT LEARNING GUIDE FORMATS

Orange County Public Schools

Attachment A



1 COVER PAGE

- Identifies the school.
- Identifies the district course title/number.
- Identifies the duty/unit of instruction.
- Identifies the competency number and statement.
- Contains the introduction.
- Presents the performance objective and enablers.

2 LEARNING EXPERIENCES

- Contains the performance enabler.
- Lists learning activities.
- Lists special instructions.

3 INSTRUCTION SHEET

- Provides a means for instructors to present supplemental information.
- Can contain facts, concepts, diagrams, drawings, illustrations, etc.

4 SELF-CHECK

- Provides students with frequent and immediate feedback on their progress.
- Includes self-check answer key.

5 PERFORMANCE TEST

- Evaluates student's ablility to perform the competency.
- Contains the performance standards.
- Contains an evaluation scale.

6 KNOWLEDGE TEST

- Evaluates student's knowledge of key information.
- Contains the content of a written test.
- Controlled by the instructor, not bound with the learning guide.

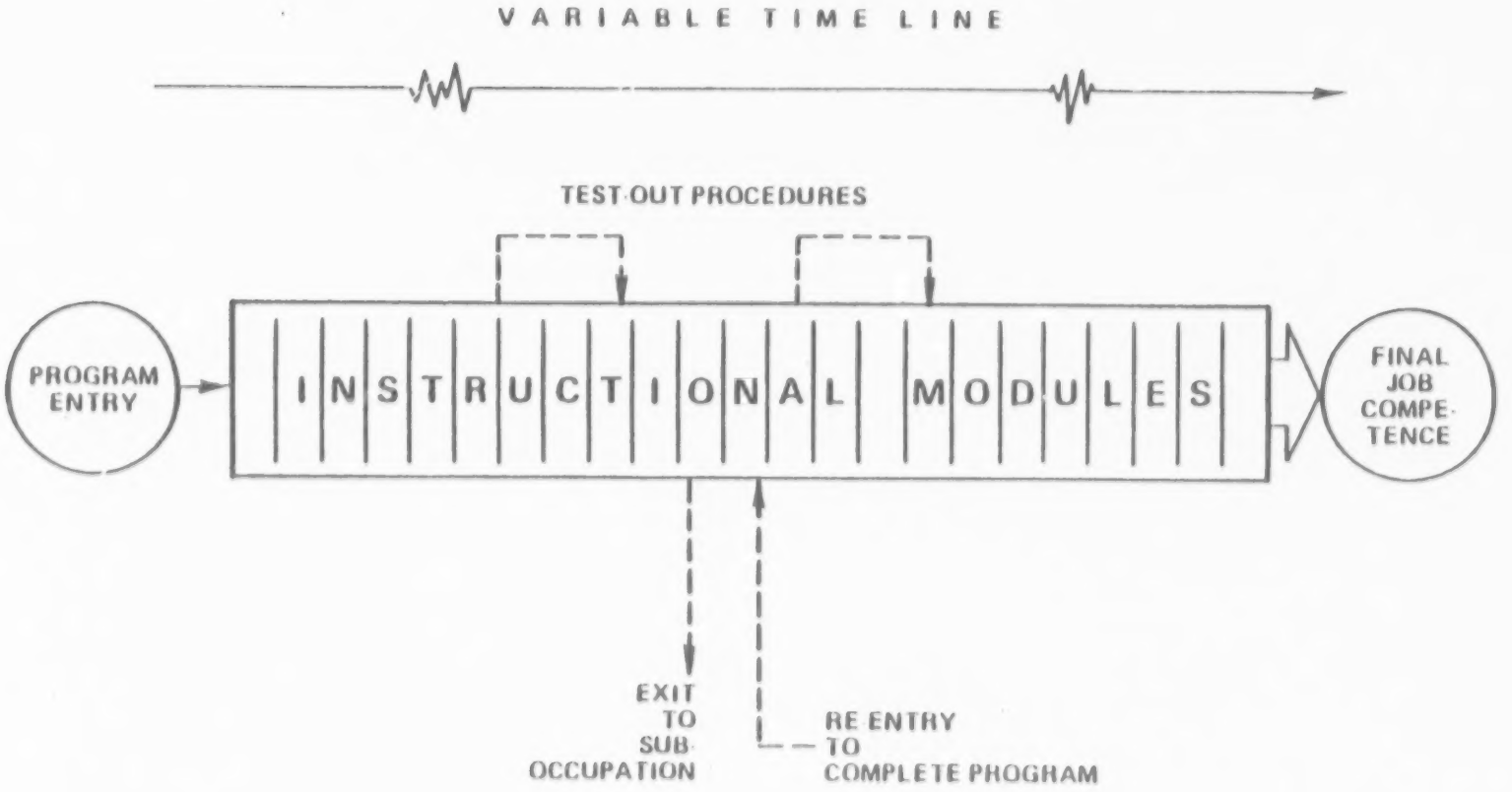
7 KNOWLEDGE TEST ANSWER KEY

- Maintained by the instructor in a secure location.

8 CONTINUATION SHEET

- Serves as all-purpose continuation sheet for the Cover, Self-Check, Performance Test, and Knowledge Test.
- Can be used for case problems and other special needs.

MODEL OF COMPETENCY-BASED VOCATIONAL PROGRAM



Attachment B

IT WORKS!

April 1987, p. 15.

A Tool for Developing Curricula

by Robert E. Norton

DACUM (Developing A Curriculum) is an approach to occupational analysis that can be used to develop a valid list of competencies for almost any job in two days. At the National Center for Research in Vocational Education, we have found it to be an effective method of quickly determining, at relatively low cost, the tasks that must be performed by persons employed in an occupation, or occupational area. The DACUM analysis can be used as a basis for curriculum development, student guidance, training needs assessments, worker performance evaluations, and performance test development.

DACUM operates on three premises: (1) expert workers are better able to describe/define their job than anyone else, (2) any job can be effectively described in terms of the tasks that successful workers in that occupation perform, and (3) workers need certain, specific attitudes and knowledge in order to perform each task correctly.

How does the process work? A carefully chosen group of about 10-12 experts from the occupational area form a DACUM committee. Committee members are recruited directly from business, industry, or the professions. The committee works under the guidance of a trained facilitator for two days to develop a DACUM chart, which is a detailed and graphic portrayal of the tasks involved in the occupation being studied.

Guided by the facilitator, the DACUM committee identifies general areas of job responsibility, pinpoints specific tasks performed in connection with each duty, reviews and refines the task and duty statements, sequences them, and identifies entry-level tasks. Modified and structured small-group brainstorming techniques are used to obtain the collective expertise and consensus of the committee. High-quality task and duty statements usually result from this interaction. The DACUM analysis also results in lists of tools, equipment, supplies, and materials pertinent to the occupation; traits and attitudes important to workers in that occupation; and general knowledge and skill areas that are prerequisites to job performance.

Because of their current occupational expertise, committee participants do not need to make any advance preparations. Participants on past DACUM committee have, without exception, found the activity to be professionally stimulating.

Once the DACUM chart is developed, we recommend one more procedure—task verification (or "validation," as some prefer to call it). Verification is the process of having experts review and confirm or refute the importance of the task statements. Reviewers are usually selected from the ranks of practicing workers or immediate supervisors of such workers. Commonly a "task inventory" questionnaire is prepared and used to collect the desired information. We feel there are several strong arguments for verification: it provides further evidence that you have the right tasks, it permits greater involvement of business and industry representatives, and it elicits greater public confidence in the relevance of the programs involved.

The DACUM process is particularly useful when a new secondary or postsecondary occupational program is to be offered. When conducted at the user's institution, the process results in two benefits: the institution obtains a solid, locally relevant job analysis as a basis for curriculum development, and receives immediate, strong support for the new program from the business and industrial community. This support results from the substantive involvement of industry people, who tell their supervisors about the relevant programs that institution X is implementing. Often several, if not all, DACUM panel members later serve on an advisory committee for the new program. Institutions that have used the DACUM process often receive donations of equipment and supplies from local employers. Some facilitators even report active recruitment of students for the new program by the panel members.

At this point, you may be wondering how a DACUM analysis differs from other types and sources of job analysis information. An analysis done somewhere else may or may not be relevant to your community. Hence, some type of local verification process should be considered essential. It may cost less to "import" an analysis from another source, but the school is not likely to receive the same value that it derives from a local DACUM analysis.

About the Author
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ATTACHMENT D

SOME TASK RATING OPTIONS

1. IMPORTANCE OF THE TASK -- refers to its criticality to the overall job.

2. TASK LEARNING DIFFICULTY -- refers to how difficult it is to learn to perform the task satisfactorily.

3. FREQUENCY OF TASK PERFORMANCE -- indicates how frequently the task is performed by workers.

4. TIME SPENT PERFORMING THE TASK -- indicates the approximate percentage of work time spent performing the task.

5. CONSEQUENCE OF INADEQUATE PERFORMANCE -- indicates the degree to which inadequate performance affects personnel, equipment, etc.

6. TASK DELAY TOLERANCE -- refers to the amount of delay that can be tolerated without undesirable results.

7. ENTRY LEVEL -- indicates whether performance of this task is expected of beginning workers.

8. PROBABILITY OF DEFICIENT PERFORMANCE -- indicates how likely it is that the task will be performed unsatisfactorily.

9. PERCENT PERFORMING -- indicates the percentage of job holders who actually perform this task.

10. DEGREE OF TRAINING NEEDED -- indicates the amount of training that most workers will need in order to effectively perform the task.

Task # 2.14 - ADDRESS SAFETY ISSUES

In performing this task the Research Scientist/Engineer in Fuels Utilization Technology will need to:

COMPLETE THESE STEPS	KNOW THE FOLLOWING	EXHIBIT THESE ATTITUDES
1. Incorporate safety considerations into equipment design	Relevant design and safety codes	
2. List laboratory activities to be conducted	Scope of project	
3. Determine experience of technical staff in conducting these activities	Assessment procedures	No one is too experienced
4. Identify hazards (electrical, chemical, thermal, mechanical) associated with each activity	The nature of safety hazards How to identify safety hazards	Concern for welfare of workers
5. Analyze experimental protocol for obvious trouble areas	Common safety violations	Non-assuming
6. List all activities that could turn out wrong, causing an accident		Open, and creative mind
7. Formulate a worst-accident situation		
8. Review safety procedures		Cost of safety is never too high
9. Prepare an action plan to respond to a major accident		
10 Educate staff and management on all safety issues		
11. Train staff to recognize potential hazards, and how to react to an accident	Locations of safety equipment; exits; alarms	
12. Conduct periodic safety checks		Be uncompromising
13. Interface with organization safety		

Attachment F

TASK ANALYSIS FORM

DUTY: Pickup Freight E

Date: 2/7/90

TASK: Load Freight E 10

Content Expert(s): 2 P&D Drivers X 5 Div.

Recorder: Dan Mathias

3 bills (3 skids and 28 cartons) Steps	Standards (How Well)	Tools, Equipment, Materials, & Supplies	Related Knowledge	Safety	Attitudes
1) Clean floor of trailer 2) Put dock plate in place 3) Load bill with largest freight first 4) Check that labels are up and out 5) Load loose cartons high and tight 6) Use dunnage if needed and available 7) Load last bill 8) Check that all freight has been loaded	-- No damage to freight -- Floor of trailer clean -- Largest bill loaded first -- All bills loaded and complete -- Use safe work procedures -- Dunnage used, if appropriate -- Followed ECE procedures -- Light freight on top -- Space cubed out (freight high and tight) -- Time consumed	1) o Trailer o Broom 2) Dock plate 3) o Hand truck o Freight o Crowbar o Forklift o Pallet 6) Dunnage	1) Know: Whether to clean What has been spilled How to clean 2) o How to place plate o Recognize type of plate 3) o Identify particular (items) freight o Place heavy items on bottom o Distribute weight properly o Trailer capacity 4) Know ECE guidelines 5) o Place light items on top o Load properly (follow loading basics) 6) o Know when and how to use dunnage o Source of dunnage	1) Clean in safe manner (for safety) 2) Handle dock plate with caution 3) Stay clear of Hi-Lo or forklift 5) Use safe lifting procedures	1) Be alert 2) Be courteous 3) Be helpful/cooperative 4) Safety conscious

99

100

82

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DECISIONS	CUES	ERRORS
Identify Decisions that Must be Made	Identify the Data Needed for Making Correct Decisions	Indicate What Will Result if Incorrect Decisions are Made
1) Decide whether floor needs to be cleaned	1) Nails, trash, etc. on floor	1) o Damage to freight o Injury to loader/stripper o Equipment damaged
2) Decide whether plate is needed	2) Type of freight	2) o Injury to loader o Extra work
3) Decide how to place and distribute weight	3) Size and weight of shipment	3) o Damage to freight o Extra handling o Loss of space on trailer o Dangerous distribution of weight/fine
5) o Decide where to place (top or floor) o Space and weight considerations	5) o Size & type of freight o Space available	5) o Damage to cartons/freight o Personal injury
6) Decide if dunnage is needed	6) o Sharp objects o Drums o Metal objects	6) o Damage to trailer o Damage to freight
8) Decide if all freight is loaded	8) o Freight on dock o Count items	8) o Unhappy: shipper receiver company o Claims

COMPETENCY-BASED EDUCATION PROGRAM EVALUATION CHECKLIST

Program _____

Name _____

Date _____

Directions: Indicate the extent to which the program being evaluated has implemented each of the following essential elements and desirable characteristics by checking the appropriate box under Level of Implementation.

	Level of Implementation			
	Poor	Fair	Good	Excellent
A. ESSENTIAL CHARACTERISTICS:				
1. Competencies to be achieved by the students have been:				
a. carefully identified	☐	☐	☐	☐
b. verified by local experts	☐	☐	☐	☐
c. made public	☐	☐	☐	☐
2. Criteria for assessing each of the verified competencies have been:				
a. derived from analysis of the competencies	☐	☐	☐	☐
b. explicitly stated along with conditions	☐	☐	☐	☐
c. made public	☐	☐	☐	☐
3. Instructional program provides for the:				
a. individual development of each competency	☐	☐	☐	☐
b. individual assessment of each competency	☐	☐	☐	☐
4. Assessment of the students' competency:				
a. takes knowledge into account	☐	☐	☐	☐
b. takes attitudes into account	☐	☐	☐	☐
c. requires actual performance of the competency as the major source of evidence	☐	☐	☐	☐
5. Students progress through the program:				
a. at their own rate	☐	☐	☐	☐
b. by demonstrating their competence	☐	☐	☐	☐
B. DESIRABLE CHARACTERISTICS				
6. Instruction is individualized to the maximum extent possible	☐	☐	☐	☐
7. Learning experiences are guided by frequent feedback	☐	☐	☐	☐
8. Emphasis is upon students' achievement of exit requirements	☐	☐	☐	☐
9. Instruction is individually paced rather than time-based	☐	☐	☐	☐
10. Instruction is field-centered using realistic work situations and actual on-the-job experiences	☐	☐	☐	☐
11. Instructional materials are:				
a. modularized	☐	☐	☐	☐
b. mediated	☐	☐	☐	☐
c. flexible with both required and optional learning activities provided	☐	☐	☐	☐
12. The instructional program as a whole is carefully planned and systematic—evaluation data is used for program improvement	☐	☐	☐	☐

Level of Implementation: In a fully implemented CBE program, all items will receive an excellent response. If any item receives a Poor or Fair response, you should meet with your competency-based education program coordinator to determine what changes are needed and how you can get help in making them.

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Center on Education and Training for Employment, The Ohio State University, Columbus, Ohio.

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